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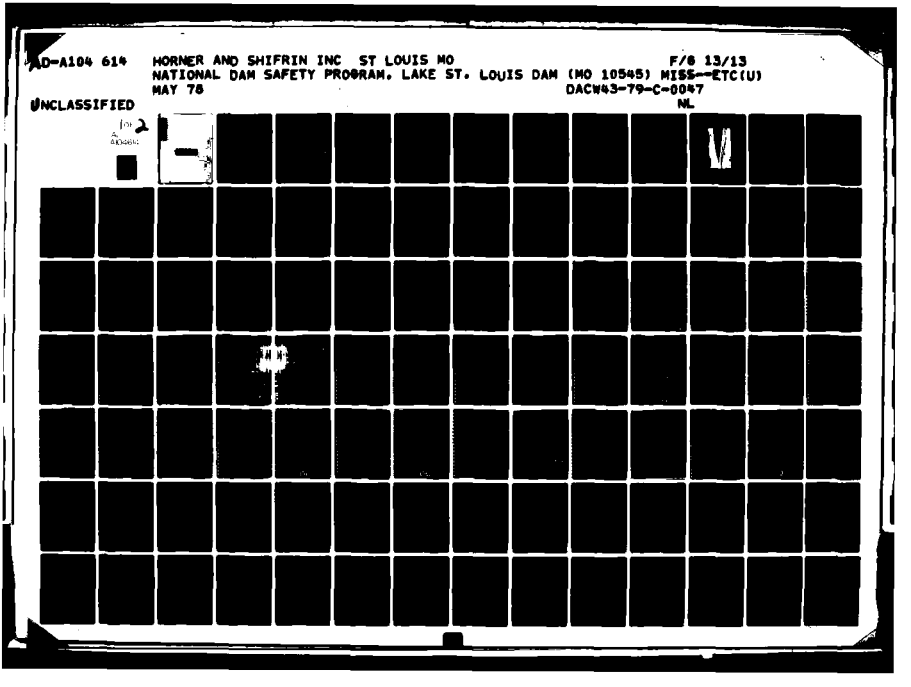

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This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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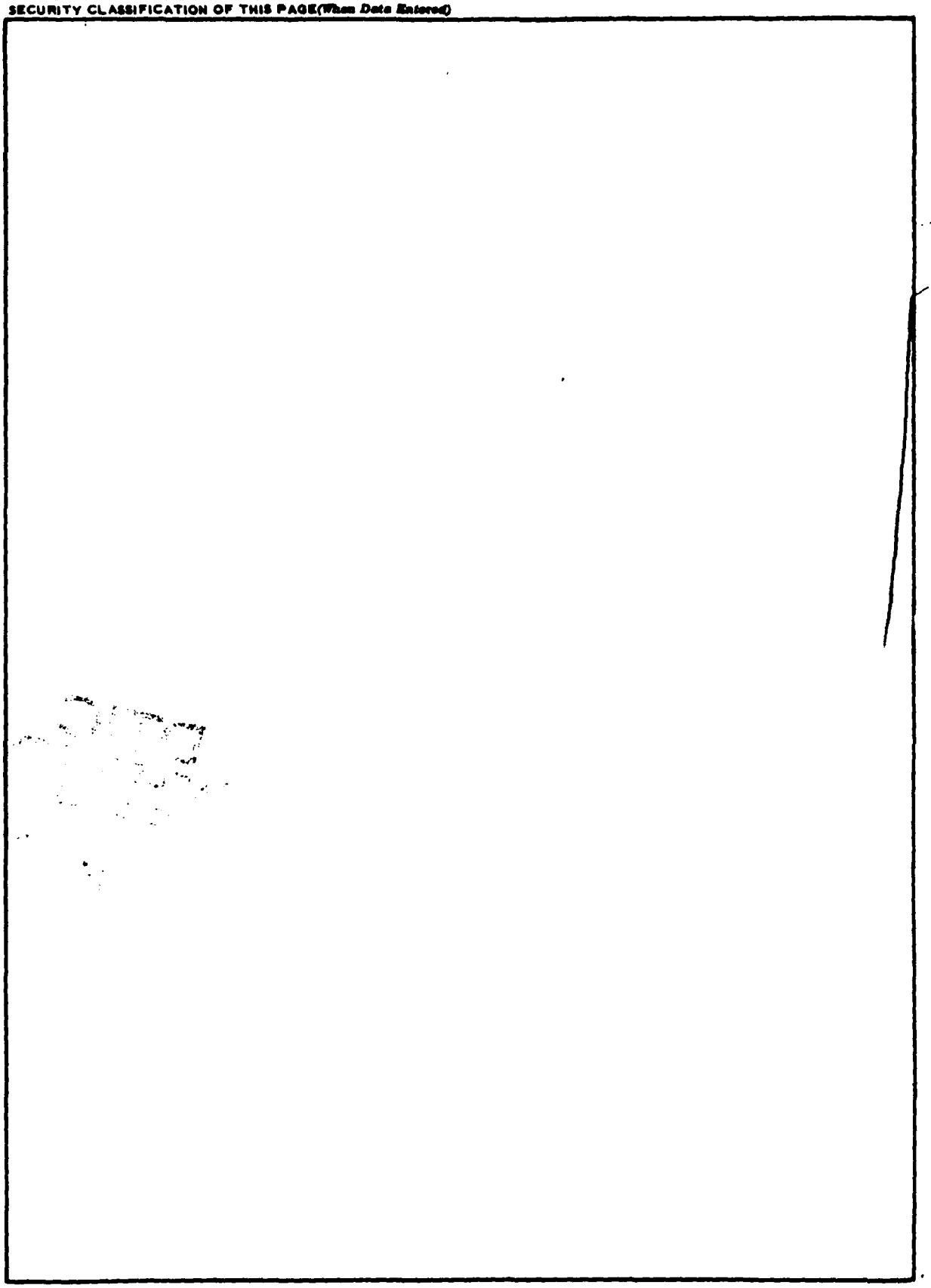

LAKE ST. LOUIS DAM
ST. CHARLES COUNTY, MISSOURI

MISSOURI INVENTORY NO. 10490

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED BY:

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FOR:

U.S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS

MAY 1978

HS-7812

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

SUBJECT: Lake St. Louis Phase I Dam Inspection Report

This report presents the results of field inspection and evaluation of the Lake St. Louis Dam. It was prepared under the National Program of Inspection of Non-Federal Dams.

SUBMITTED BY: _____ 15 June 78
Chief, Engineering Division — Date

APPROVED BY: _____ 15 June 78
Colonel, CE, District Engineer — Date

PHASE I REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Lake Saint Louis
State Located:	Missouri
County Located:	St. Charles
Stream:	Peruque Creek
Date of Inspections:	2 February 1978 and 22 March 1978

Based on a visual inspection and a review of performance history, the present general condition of the Lake Saint Louis dam and spillway is considered to be good. The following deficiencies were noticed during the inspection and are considered to have an adverse effect on the overall safety and future operation of the dam and spillway:

a. Corrosion of the 72-inch steel drawdown pipe along with some loss of section due to flaking at the water line was observed. This condition is not considered serious at this time.

b. The 72-inch drawdown pipe terminates at a point approximately in line with the downstream toe of the dam slope. There exists a possibility of erosion at the outlet during pipe discharge and the subsequent undermining of the dam.

c. Erosion of the lakeside spillway outlet channel bank near station 12+90 was observed. This erosion is producing a concentration of flow at this point which could result in undermining of a portion of the spillway overflow section.

d. Overflow of sewage at the wet well of the sewage lift station was noted at the time the downstream side of the dam was inspected.

There remains, until further investigations are made, some doubt as to the cause of the overflow. One of the reasons for the overflow occurring may be due to a surcharged condition which in turn may be due to excessive infiltration of the sewer line. It is important to verify if excess infiltration is occurring and that such is not the case immediately upstream or downstream or below the dam.

Based on evaluation of hydraulic-hydrologic data, it was found that the spillway outlet channel does not meet the criteria set forth in the guidelines for dam safety inspection work, furnished by the Department of the Army, office of the Chief of Engineers, for a dam of the size and hazard classification designated. The outlet channel, in order to satisfy the specified criteria, would be required to pass a flow of 86,000 cfs, which is equivalent to maximum probable flood (MPF). The spillway channel, as it is believed to presently exist, will pass a flow of 38,300 cfs. Spillway discharges of magnitudes greater than 38,300 cfs will result in a backwater condition developing over the spillway weir crest and a loss of spillway capacity due to weir submergence. Once submergence occurs the lake level will rise progressively until equilibrium of flow to the weir crest and channel outflow is reached, or until the dam is overtopped. The probability of a flood producing lake outflows of 38,300 cfs is believed to be greater than once in one thousand years.

A review of available data did not disclose that seepage and stability analyses of the dam were performed. Portions of the downstream toe of slope were found to be soft and wet. At the time of inspection it could not be concluded if this condition is due to seepage, ground thaw, surface runoff from snow and ice, or a combination thereof.

It was noticed during the inspection of the area in the vicinity of the dam that a number of liquid petroleum tanks have been installed immediately downstream from the Lake Sainte Louise Dam. The proximity of

these tanks to the Lake Saint Louis Dam presents a hazardous condition should failure of this dam occur. The owner is advised to investigate the safety of this dam and, if necessary, based on the results of this investigation, relocate the tanks.

It is recommended that the owner take the necessary action in the near future to correct or control the deficiencies reported herein.

Albert B. Becker, Jr.
P.E. Missouri E-9168

George K. Hasegawa
P.E. Missouri E-4551

OVERVIEW OF LAKE AND DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
LAKE SAINT LOUIS DAM - ID NO. 10490

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
LAKE SAINT LOUIS DAM - ID NO. 10490

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority. National Dam Inspection Act, Public Law 92-367, dated 8 August 1972.

b. Purpose of Inspection. The purpose of this inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam and spillway pose a hazard to human life or property.

c. Evaluation Criteria. This evaluation was performed in accordance with the "Phase I" investigation procedures as prescribed in "Recommended Guidelines for Safety Inspection of Dams" Appendix D, published by the Department of the Army, Office of the Chief of Engineers.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances. The Lake Saint Louis dam is an earthfill type dam rising approximately 47 feet above the original stream bed. Lake level is governed by a continuous concrete overflow type spillway approximately 810 feet in length with a side channel outlet. The spillway outlet channel is in rock cut to a point downstream from the dam where the channel transitions to the original drainage course of Peruque Creek. A 72-inch diameter steel pipe with a manually operated sluice gate serves the lake for drawdown purposes. Lake Saint Louis Blvd. traverses the dam crest crossing the side channel spillway at the west end of the dam. A general plan of the dam and spillway is shown on Plate 2.

b. Location. The dam and lake are located on Peruque Creek approximately 6 miles west of O'Fallon, Missouri, in St. Charles County, as shown on the map on Plate 1. The dam is located immediately upstream of the Interstate 70 crossing of Peruque Creek in Section 26, Township 47 North, Range 2 East.

c. Size Classification. The classification for size based on the height of the dam and storage capacity is categorized as intermediate. (Per Table 1, Recommended Guidelines for Safety Inspection of Dams, Appendix D.)

d. Hazard Classification. The Lake Saint Louis Dam has a high hazard potential, meaning that the dam is located where failure may cause more than a few lives lost, serious damage to homes, extensive agricultural, industrial and commercial facilities, important public utilities, main highways, or railroads. Further, the flood damage zone downstream of the dam was estimated to be ten miles. Within this damage zone are eight bridges, four of which are major bridges and includes Interstate Highway 70, three additional highways, and seven homes. Eleven additional homes may be subject to backwater flooding. The flood plain is extensively farmed.

e. Ownership. The dam is owned by the Lake Saint Louis Community Association, 20 Ellerman Road, Lake Saint Louis, Missouri, 63367. The association presently consists of 2,443 home and/or property owners.

f. Purpose of Dam. The dam impounds water for the purpose of recreation, for surrounding residential property owners, who are part of the Lake Saint Louis Community Association.

g. Design and Construction History.

(1) A hydrologic and hydraulic study of the proposed dam and lake was made in 1966 by the firm of Spence & Weinel, Inc., Consulting Engineers, St. Louis, Missouri, for the potential developers of the Lake Saint Louis subdivision property. This report recommended that the design of the dam and spillway be predicated on what the writers termed an Assumption A flood.

The flood for Assumption A is approximately equivalent to one-half the maximum probable flood (MPF). It was also stated in the Spence & Weinel report that if the MPF would not greatly increase the height of the dam it would be desirable to design the dam for this flood.

(2) The design of the dam and spillway was prepared during 1968 by Bernard G. Browning, P.E., Fulton, Missouri, for Lake Saint Louis Estates, Inc., which was then the site developer. Construction of the dam was started with the cut off trench excavated and fill approximately 20 feet in depth placed in the eastern portion of the dam. The 24-inch cast iron sanitary sewer pipe that runs down the center of the lake was installed across the dam site and the 72-inch steel drawdown pipe was also installed. Due to frequent flooding, the contractor was unable to place the impervious fill in the cut off trench in the vicinity of the Peruque Creek channel.

(3) In 1969, at the request of the ultimate developers, the Lake St. Louis Investment Corporation, Horner & Shifrin, Inc., Consulting Engineers, was engaged to review the design of the spillway and subsequently was authorized by the developers to redesign it. The spillway as designed by Horner & Shifrin, Inc., was based on the Assumption A flood.

(4) Horner & Shifrin, Inc. was also engaged to provide inspection services during the remaining construction of the dam and spillway. A steel sheet piling cut off was substituted for about 220 feet of the cut off trench in the vicinity of the creek channel and earth fill placed across the entire dam. The earth fill for the dam was essentially completed during the summer of 1970 with Horner & Shifrin, Inc. inspecting the placement and compaction of the fill. The overflow spillway and outlet channel were completed during the summer of 1973.

h. Normal Operational Procedure. The lake level is regulated by overflow of an uncontrolled spillway.

1.3 PERTINENT DATA

a. Drainage Areas. The areas tributary to the lake are primarily agricultural in use with a small amount of urban development. The watershed above the dam is approximately 17 miles long and the width varies to a maximum of about 5 miles. The total area is approximately 56.4 square miles (36,100 acres). The watershed area is outlined on Plate 1.

b. Discharge at Damsite.

(1) Estimated known maximum flood at damsite ... 4,500 cfs

(2) Overflow spillway capacity (including side outlet channel) ... 36,000 cfs

(3) Gated 72-inch drawdown pipe capacity at normal pool elevation ... 700 cfs

c. Elevation (ft. above MSL).

(1) Top of dam ... 512.0

(2) Maximum pool-design surcharge ... 510.3[1]

(3) Normal pool ... 500.5

(4) Spillway crest, normal pool section ... 500.5

(5) Spillway crest, flood section ... 501.0

(6) Streambed at centerline of dam ... 465.6

(7) Maximum tailwater ... Unknown

d. Reservoir.

(1) Length of maximum pool (elevation 510.3) ... 5.6 miles[1]

(2) Length of normal pool (elevation 500.5) ... 4.3 miles

e. Storage.

(1) Normal pool ... 6,300 Ac.Ft.

(2) Design surcharge (incremental) ... 6,900 Ac.Ft.

(3) Top of dam (incremental) ... 1,450 Ac.Ft.

(1) For MPF assuming free discharge condition of outlet channel.

f. Reservoir Surface.

(1) Top of dam ... 880 Acres

(2) Maximum pool ... 830 Acres(1)

(3) Spillway crest ... 563 Acres

(4) Normal pool ... 546 Acres

g. Dam.

(1) Type ... Earthfill, homogenous

(2) Length (approximate) ... 900 Ft.

(3) Height ... 47 Ft.

(4) Top Width ... 55 Ft.

(5) Side Slopes

(a) Upstream ... 1v on 3h

(b) Downstream ... 1v on 2.5h

(6) Cutoff ... Earthfill Trench/Sheet Piling

(7) Slope Protection

(a) Upstream ... Rock rip-rap, dumped

(b) Downstream ... Grass

h. Spillway.

(1) Type ... Concrete

(2) Approximate length ... 810 Ft.

(3) Crest elevation (feet above MSL)

(a) Normal pool section ... 500.5

(b) Flood section ... 501.0

(4) Upstream Channel ... Lake

(5) Downstream Side Channel

(a) Rock cut, approximate length ... 970 Ft.

(b) Bottom width ... 40 Ft. (min.), 70 Ft. (max.)

i. Outlet for Lake Drawdown.

(1) Type ... Steel pipe, 72-inch diameter

(2) Length ... 267 Ft.

(3) Control ... Sluice gate, manually operated

(1) For MPF assuming free discharge condition of outlet channel.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

a. Subsurface Investigations. Available test borings and other data for subsurface investigations for both the dam and spillway are included on Plate 14 and Charts 2-1 through 2-54. Geological investigations and reports prepared prior to the construction of the dam by the Missouri Geological Survey are included on Charts 2-55 through 2-60.

b. Dam. The dam was designed as a homogenous earthfill type embankment. The materials used, clays and silts, were obtained from nearby hillside and valley borrow areas. An impervious earthfill cutoff trench was designed to reduce the underseepage and prevent loss of water from the lake. A 72-inch diameter steel pipe with a manually operated control gate was provided for the purpose of unwatering the lake. Plans indicating the original design requirements of the dam are unavailable.

c. Spillway and Outlet Channel. The fixed crest spillway was designed as a concrete gravity section bearing on rock. The outlet channel was designed as a rock (limestone) cut section to a point about 400 feet downstream from the dam centerline to where the channel transitions to the original drainage course of Peruque Creek. The outlet channel has a bottom width varying from 40 feet at the upstream end to 70 feet at the downstream end. The channel side slopes in rock cut were specified to be 1 horizontal to 4 vertical. Details of the concrete gravity spillway as well as the side channel outlet are shown on the plans titled "Lake Saint Louis Main Dam," dated 17 July 1972, and are included as Plates 10 through 13. Due to flow in the spillway outlet channel, the elevation of the invert based on survey was not obtained. However, it is believed that the channel was not excavated to the full depth shown in the plans but that the invert near the downstream end is about 4.5 feet higher than specified.

2.2 CONSTRUCTION

a. Dam. At the time Horner & Shifrin was engaged by the Lake St. Louis Investment Corporation, the earthfill dam, including cutoff trench, had been under construction for some time. Approximately 20 feet of fill was in place near the east abutment. The 72-inch drawdown pipe as well as the 24-inch sanitary sewer pipe had also been installed beneath the main body of the dam. However, due to flooding of the excavation, the contractor had been unable to place the impervious fill for the cutoff trench in the vicinity of the old creek channel.

Under the surveillance of Horner & Shifrin, a steel sheet piling cutoff was substituted for the earthfill trench section from station 19+14 to station 21+31 in order to proceed with construction of the dam. Placement of the remaining fill was monitored and the compaction effort recorded. The 72-inch drawdown pipe was extended some 34 feet to a point just beyond the downstream toe of slope, a headwall was constructed on the upstream end of the 72-inch pipe, and construction of the gatewell structure was completed.

Plans for modifying the 72-inch pipe, including construction of the gatewell and upstream headwall, as well as cross-sections used to complete construction of the dam are shown on Plates 3 through 9. Photographs of the dam taken during construction are included on Page A-1 of the Appendix.

b. Spillway and Outlet Channel. Construction of the concrete spillway section was accomplished according to plan with the exception of the reach between stations 4+60 and 6+38. Due to poor rock foundation conditions, as indicated by the test borings, it was planned to construct an earthfill embankment section in this area. When excavation of the overburden in this area revealed that the foundation rock could be satisfactorily utilized, and at the request of the developer, it was decided to extend the concrete overflow section through this reach and eliminate the earthfill embankment. Considerable effort was expended removing badly weathered rock, cleaning the earth

filled cavernous rock areas, and filling with concrete the resulting voids within the limits of the overflow section in order to attain a sound, impervious foundation. Photographs taken during construction showing an area of the cavernous rock foundation that has been prepared for filling with concrete, as well as other photographs taken during construction of the spillway overflow section, are included on Pages A-2 through A-5 of the Appendix.

The outlet channel was excavated in limestone by drilling and blasting. Side slopes were maintained at 4 vertical to 1 horizontal. The alignment of the channel was maintained essentially as planned, however it is believed that the invert was constructed higher than the profile grades specified. No evidence of faulting of the bedrock during excavation of the channel was noted.

2.3. OPERATION

Lake level is governed by overflow of the uncontrolled spillway. The gate on the 72-inch outlet pipe is maintained closed and used only for lake drawdown purposes.

2.4 EVALUATION

a. Availability. Engineering data available for assessment of the spillway and outlet channel design was substantial. The data available for assessment of the design of the dam was found lacking with regard to the soil strengths of the foundation and embankment.

b. Adequacy. Since soil strength data is unavailable to make a complete assessment of the design of the dam, it is recommended that the owner engage a qualified engineer to obtain the necessary soil test data and to perform detailed stability and seepage analyses.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General. A visual inspection of the dam, spillway, outlet channel, the outlet end of the drawdown pipe, and other related features was made by Horner & Shifrin engineering personnel on 2 February 1978 and 22 March 1978. Also inspected was the Highway 40-61 Bridge crossing Peruque Creek at the upstream end of the lake and the various bridges crossing Peruque Creek from the dam downstream to Highway 79. Below Highway 79 the stream emerges onto the flood plain of the Mississippi River and is considered to be the downstream limits subject to damage by flooding should failure of the dam occur. Photographs of the dam, spillway, and the Highway 40-61 Bridges are included on Pages B-1 through B-6 of the Appendix.

b. Dam. The upstream and downstream slopes of the dam were found to be in good condition except for some erosion, caused by surface storm runoff, of the downstream slope where the dam joins the east abutment and of the upstream slope at the east abutment of the Lake Saint Louis Boulevard Bridge.

The downstream toe of slope was found to be soft and wet in several areas. At this time of the year, it cannot be concluded if this condition is due to seepage, ground thaw, surface runoff, or a combination of all the aforementioned.

The downstream flood plain adjacent to the dam was also noticeably wet, with ponded water appearing in several locations, however this condition can be attributed to poor drainage of surface runoff and to overflow of the sewage lift station wetwell. Details of the sewage lift station and wetwell are shown on Plate 15.

c. Drawdown Pipe. The 72-inch uncoated steel pipe provided for unwatering the lake was rusted and showed signs of corrosion at the water line.

Water could be heard entering the upstream end of the pipe, presumably due to leakage about the control gate. A minor quantity of water was noticed flowing from the pipe. Since, at this time, the pipe was two-thirds full of backwater caused by downstream channel obstruction, an internal inspection of the pipe from the outlet to the gate was not undertaken. The exposed elements of the gate operator and gatewell structure appeared to be in good condition.

d. Spillway and Outlet Channel. The fixed crest concrete spillway section appeared to be in good condition. No deterioration of the concrete due to weathering or damage from ice was observed. Leakage at the vertical joints between adjacent sections was not appreciable. A significant amount of erosion of the left bank of the outlet channel between the overflow section and the channel has occurred in the vicinity of channel station 12+40. The erosion is the result of the washing out of the soil fill in the existing solution channel in the limestone bedrock on which the spillway is constructed. A picture of the erosion of the solution channel is shown on Photograph No. 8 of the appendix. At the time of construction of the spillway, the portion of the solution channel occurring below the spillway was thoroughly cleaned of earth and backfilled with concrete. The erosion has partially exposed the concrete fill. The solution channel is about 20 feet wide at the top and is estimated to be about 40 feet in length. It appeared that the erosion has nearly stabilized and that erosion from this time on would be due to weathering of the exposed rock surfaces. Loss of the bank is causing spillway discharge to concentrate at this location. Additional erosion of the bank was noticed along the east side of the paved chute downstream from the normal pool control section. The outlet channel banks, with the exception of the loss of section in the vicinity of station 12+40, were found to be in good condition and maintaining their slopes. Some areas of the channel bottom did have an accumulation of large stones and boulders, apparently due to sloughing of loose rock along the upper regions of the right bank.

e. Highway 40-61 Bridges. The Highway 40-61 Bridges at the upstream end of the lake were visually examined during the inspection of 22 March 1978. No

noticeable adverse effects due to the presence of the lake were detected. The lake at the time of the inspection was approximately 6 inches above normal pool level at the spillway.

f. Downstream Channel. The Peruque Creek channel downstream from the dam is unimproved. The flood plain between the dam and the Highway 79 Bridge, approximately 9 miles downstream, varies in section with the average width being approximately 1,500 feet. The narrowest section, approximately 600 feet in width, occurs at a point approximately 1 mile upstream from the Highway 79 Bridge or roughly 8 miles downstream from the dam. The stream is crossed, beginning at the dam and proceeding downstream by the I-70 South Outer Road Bridge, the I-70 East Bound and West Bound Bridges, the North Outer Road Bridge, the Norfolk & Western Railroad Bridge, Hoff Road Bridge, County Route P Bridge, a private road bridge, County Route M Bridge, and State Highway 79 Bridge. The flood plain is principally farm land; however, it is being developed in some areas with several homes completed and occupied. In addition, primarily along Route M, there are several older residences that lie within the flood plain limits.

3.2 EVALUATION

Deficiencies observed during this inspection and noted herein are not considered significant or of serious potential to warrant immediate remedial action.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

Since the spillway is uncontrolled and the lake drawdown pipe is maintained closed, there are no gated facilities for controlling lake discharge.

4.2 MAINTENANCE OF DAM

A visual inspection of the dam and spillway is normally performed by personnel of the Lakes and Parks Department, Lake Saint Louis Community Association, on a monthly basis. This inspection is done on foot and includes examination of the dam slopes, the area immediately downstream from the dam, the gate structure, the spillway, and the spillway outlet channel. The grass on the dam slopes and downstream berm is mowed on a regular basis. Shrubs and trees are not permitted in these areas. Animal burrows are filled when noticed. No records are kept of these inspections or maintenance performed.

4.3 MAINTENANCE OF SPILLWAY AND OUTLET CHANNEL

To date, it would appear that little maintenance work has been performed in the spillway area as is evident by the erosion of the channel bank in the vicinity of station 12+40 and the accumulation of boulders and large rocks in the outlet channel.

4.4 MAINTENANCE OF LAKE DRAWDOWN CONTROL GATE

The gate on the 72-inch drawdown pipe is the only mechanical item capable of being operated. It has been reported by the Director of the Lakes and

Parks Department that the gate is in operating condition although it leaks moderately in the closed position. The gate operator was well lubricated and appeared to be in good condition.

4.5 DESCRIPTION OF WARNING SYSTEM

There presently is no warning system in effect in case of extreme high water or sudden failure of the dam. With a county maintained road traversing the dam crest and a bridge crossing the spillway outlet channel, there is rather frequent observation of the lake conditions and the overflow of the spillway by many interested residents of the area. Due to the presence of a large number of people in the dam vicinity, it is likely that adequate warning of overtopping of the dam would be given if such a condition was developing.

4.6 EVALUATION

The presence of full-time employees under responsible supervision, as is the case at Lake Saint Louis, to maintain and inspect the dam, is considered beneficial to the safety of the dam. It is recommended that maintenance on a regular basis of the spillway outlet channel be included along with the other normally maintained features. The owner should determine if ponded water on the berm immediately below the dam is due to overflow of the wetwell. Saturation of the berm due to poor drainage is undesirable since it has an adverse effect on the stability of the dam. The owner should provide positive means for draining surface runoff in this area.

In order to insure proper operation of the sluice gate on the lake drawdown pipe, the gate should be periodically opened fully and closed.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data. The hydraulic and hydrologic data for the design of the dam and spillway is available. Beginning with the 1966 study by Spence and Weinel and continuing with the investigations by Horner & Shifrin for the design of the spillway, it was concluded that the hydraulics of the spillway and the hydrology of the lake and upstream tributary area have been sufficiently investigated. Data used for hydrologic computations is presented on Page C-1 of the Appendix.

The design of the spillway and outlet channel was based on the Assumption A flood which is approximately equivalent to one-half of the maximum probable flood (MPF). Under the Assumption A flood, the peak inflow to the lake amounts to 44,800 cfs, while for MPF the peak inflow amounts to 90,500 cfs. For a storm with a frequency of once in 300 years the peak inflow to the lake would be 13,600 cfs, and for a frequency of once in 100 years the peak inflow amounts to 10,700 cfs. Hydrographs for lake inflow and outflow for PMF, Assumption A, and 300 year storm are presented on Plate 16. Lake outflow is based on spillway crest length believed to have been constructed.

The limiting factor governing the level of the lake, based on hydraulic investigations, was found to be the capacity of the spillway outlet channel. It is believed that the channel invert was not constructed to the plan elevations specified on the construction drawings prepared by Horner & Shifrin in 1972 but is approximately 4.5 feet higher. Based on the channel invert believed to presently exist, the capacity of the outlet channel was found to be 33,500 cfs without exceeding elevation 508.0 in the lake. Elevation 508.0 was considered to be the maximum lake surface elevation desirable for development of the property about the lake and therefore to be used for spillway design.

A second and smaller lake, Lake Sainte Louise, is located immediately to the west and north of Lake Saint Louis. Its location is shown on Plate 1. The main stem of the lake is roughly parallel to Lake Saint Louis and lies about 2,000 feet south of I-70 highway. The spillway for this lake discharges to an arm of Lake Saint Louis at a point approximately 7,000 feet from the main dam. An earthfill type dam, approximately 50 feet high, serves to impound water for Lake Sainte Louise. The dam lies near the upper end of the aforementioned arm of Lake Saint Louis and any discharges from Lake Sainte Louise due to the failure of the dam would be into a relatively shallow section of Lake Saint Louis and at a point where the lake is not very wide. Based on data obtained from U.S.G.S. topographic maps, the approximate surface area of Lake Sainte Louise is 75 acres and the storage volume at normal pool level is 1,070 acre-feet. The tsunami or tidal wave effect on Lake Saint Louis, should sudden failure of the Lake Sainte Louise dam occur, has not been considered in these investigations. However, failure of the dam will undoubtedly cause considerable damage to much of the development around the arm of Lake Saint Louis immediately downstream from the Lake Sainte Louise dam. Therefore, a Phase I inspection of Lake Sainte Louise is warranted.

b. Experience Data. Since completion of the spillway in September of 1973, the maximum depth of flow over the spillway weir, according to observations made by individuals at Lake Saint Louis, is believed to be 12 to 18 inches. Using a conventional formula for a broad-crested weir, a depth of 18 inches amounts to a flow of about 4,500 cfs.

c. Visual Observations. It was noticed in areas downstream from the dam that relatively low spillway discharges will force the stream out of its natural channel. This, however, is not a new condition or one that has developed since construction of the dam. Estimates of discharge that will be contained within the natural channel vary, but it is believed that flows as low as 1,500 cfs will cause the stream to flood in some areas.

d. Overtopping Potential. The potential for overtopping the dam is believed to be relatively low if the outlet channel can allow flow to discharge

at the rate required. This rate was found to be 33,500 cfs for a lake surface elevation of 508.0, and 38,300 cfs for a lake surface elevation of 512.0 (top of dam). Once the outlet channel capacity is reached, a back-water condition will develop, and additional increases in spillway discharge will result in higher lake levels. The MPF outflow, 86,000 cfs, so greatly exceeds the capacity of the spillway outlet channel that, for a flow of MPF magnitude, it is believed that the dam will be overtopped. A rating curve for the spillway outlet channel indicating the relationship of channel capacity to lake level is presented on Plate 17.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations. No evidence of instability of the dam or overflow spillway was noticed during the visual inspection of March 22, 1978. No mention of slides or other signs of instability were reported by the owner.

b. Design and Construction Data. Stability analyses of the dam section and soil shear strengths based on field or laboratory testing are not available for review. A review of the field compaction tests, obtained during placement of the rolled earth fill for the dam, indicated that for a total of 37 tests taken, 5 exceeded 95 percent of maximum dry density at optimum moisture content, per ASTM D-698, and that the average of all tests made was 92.6 percent.

Overturning and sliding stability were investigated during design of the concrete spillway overflow section in accordance with the procedures outlined in Chapter VII of the technical publication "Design of Small Dams" by the Bureau of Reclamation, U.S. Department of the Interior. The 28 day strength of the concrete was assumed to be 3,000 psi and a minimum of 6 sacks of cement per cubic yard of mix was specified. Of 25 test cylinders obtained during construction, the minimum compressive strength of the concrete cylinders tested was found to be 3,519 psi.

c. Operating Records. The dam and spillway have not been monitored in any form during the post construction period. No records have been kept of lake level, spillway discharge, dam settlement, or seepage during this time.

d. Post Construction Changes. Since completion of the dam in 1970 and the spillway in 1973, there have been no changes to these improvements.

e. Seismic Stability. Seismic forces were not considered in the design of the spillway. Since the lake is located within a Zone II seismic probability area, an earthquake of the magnitude predicted is not expected to produce a hazardous condition to the dam or spillway.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety. Based on the present condition of the dam, the physical proportions of the dam, such as the width of the crest (55 ft.) and side slope ratios (1v on 3h upstream, 1v on 2.5h downstream), knowledge of materials placed and methcds used during construction, and history of performance, the dam is believed to be capable of withstanding various normal combinations of earth and water forces applied. This capability does not, however, preclude the potential for overtopping of the dam due to storms greater than one-half maximum probable flood magnitude.

b. Adequacy of Information. Soil strength data and properties necessary to asses the overall stability of the dam were unavailable for review.

c. Urgency. The remedial measures recommended herein are not considered to be of imminent necessity. It is recommended, however, that implementation of the actions recommended in paragraph 7-2 be undertaken in the near future.

d. Necessity for Phase II. Based on the findings and assessment of the safety of the dam developed during this investigation, a Phase II study is not recommended.

e. Seismic Stability. Since the dam is located in a Zone II seismic design area, an earthquake of the predicted magnitude is not expected to be hazardous to the dam.

7.2 REMEDIAL MEASURES

a. Alternatives.

(1) The spillway side outlet channel should be enlarged in order to increase its capacity for storm runoff of maximum probable flood (MPF) magnitude.

Hydraulically the overflow spillway and dam are considered to be adequate for MPF requirements.

(2) Obtain the necessary soil data and perform seepage and stability analyses to assess the stability of the dam for conditions which the dam has not experienced. The analysis should include the necessary investigations to determine the need for a sub-drain with a filter system and other drainage devices to prevent toe softening downstream of the dam proper. In addition, investigations should be made to determine if the ponding of water on the berm downstream from the dam is due entirely or in part to overflow of the sewage lift station. Positive drainage of surface runoff in this area should be provided.

(3) A number, approximately 60, of liquid petroleum (LP) tanks are located in an area immediately downstream from the Lake Sainte Louis Dam. These tanks are serviced by O'Fallon Gas Service, Inc., and provide gas for heating of many homes and condominiums within the Lake Saint Louis development. It was calculated that if the entire volume of water in Lake Sainte Louise was allowed to discharge into Lake Saint Louis, the rise in the level of Lake Saint Louis would be on the order of 2 feet. This rise above normal pool level of Lake Saint Louis would not cause any serious damages. However, if failure of the Lake Sainte Louise dam should occur in such a way that a large volume of water would be released suddenly, the mass of water could create a wave of such magnitude that serious damage not only to the LP tank farm but also to the development about the edge of the lower lake would undoubtedly occur. It, therefore, is believed that a very hazardous condition exists and a Phase I investigation of the Lake Sainte Louise Dam is recommended.

(4) Perusal of the available records of the construction of the 24-inch sanitary sewer under the dam did not uncover sufficient information to verify the type of material or type of joints and class of pipe used. Although drawings available showed anti-seep collars were to be constructed on the sanitary sewer, verification of the fact that this was done was not possible at this time. As far as it was determined, there appears no provision on the upstream

side of the dam to isolate the sanitary sewer should failure or other problem occur in the sanitary sewer under the dam.

Due to backwater in the 72-inch lake drawdown pipe at the time of the inspection, visual examination of the interior of the pipe was not made except near its outlet. It was noted at the outlet that a considerable amount of flaking of the interior surface near the water line had occurred. Drawings which were obtained indicated that seep collars were to be constructed on the pipe under the dam. Verification of the actual construction of these collars could not be made. Since these uncertainties occur, futher investigation of the structural condition should be made of both pipe lines under the dam as well as the determination of the presence or absence of the seep collars.

b. O & M Maintenance and Procedures.

(1) The 72-inch diameter uncoated steel lake drawdown pipe should be lined or protected by some other means to eliminate the concern of its failure due to loss of section from corrosion on both the inside and outside surfaces.

(2) The lake drawdown pipe should be extended to avoid scour of foundation soils at the existing discharge location and possible undermining of the dam.

(3) If the results of the recommended stability and underseepage analyses so indicate, a subdrain with filter system should be installed in line with and approximately at the location of the downstream toe of slope of the dam. The subdrain system should have an outlet that cannot be contaminated by backflow.

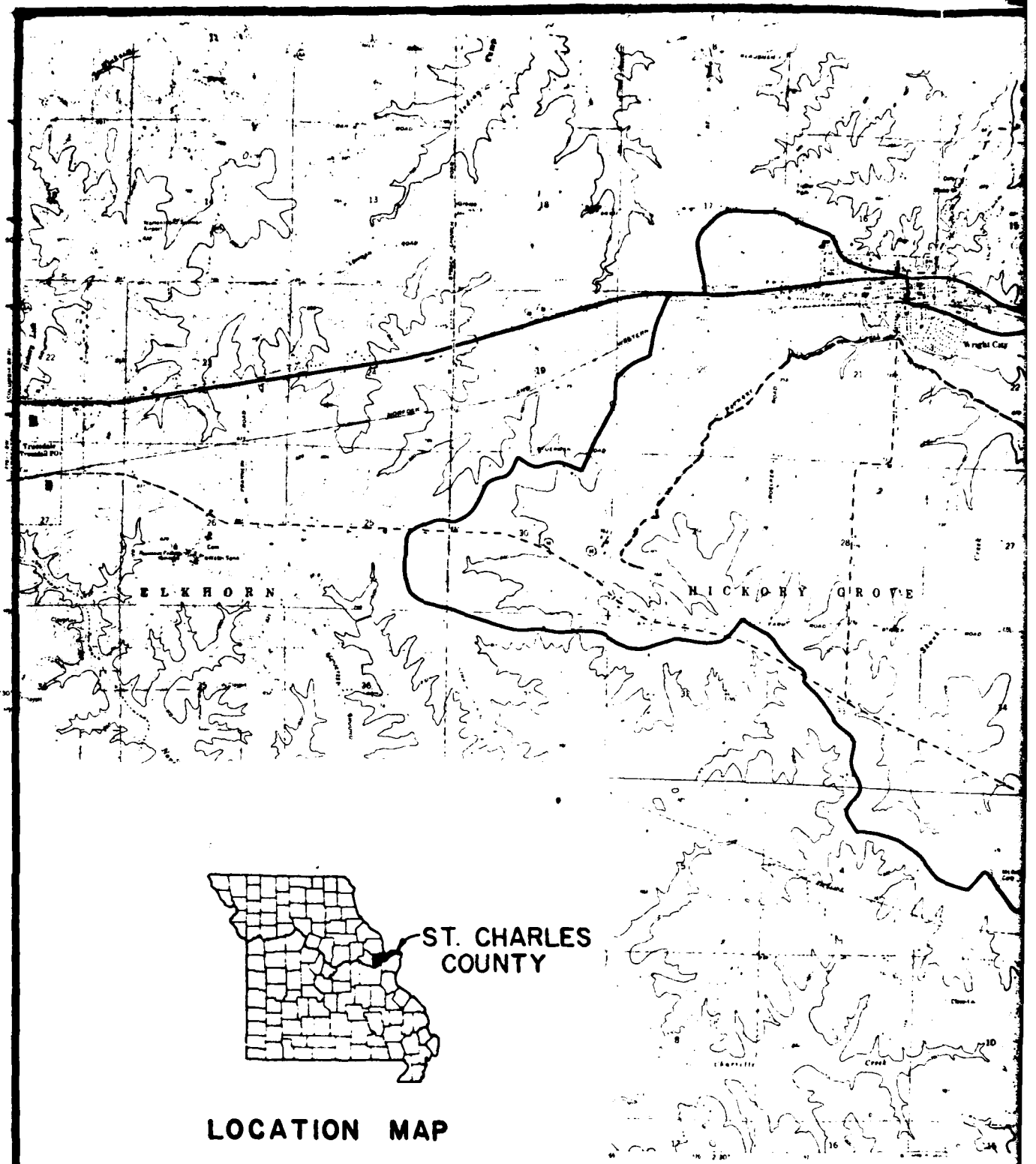
(4) The partially eroded bank of the spillway outlet channel at about station 12+40 should be restored. The overflow spillway foundation should be carefully examined for undercutting when this work is performed and any voids or openings discovered should also be restored.

(5) The eroded area on the east side of the spillway chute for the normal pool control section should be repaired so as to prevent additional erosion of the bank and undercutting of the bay and channel bottom.

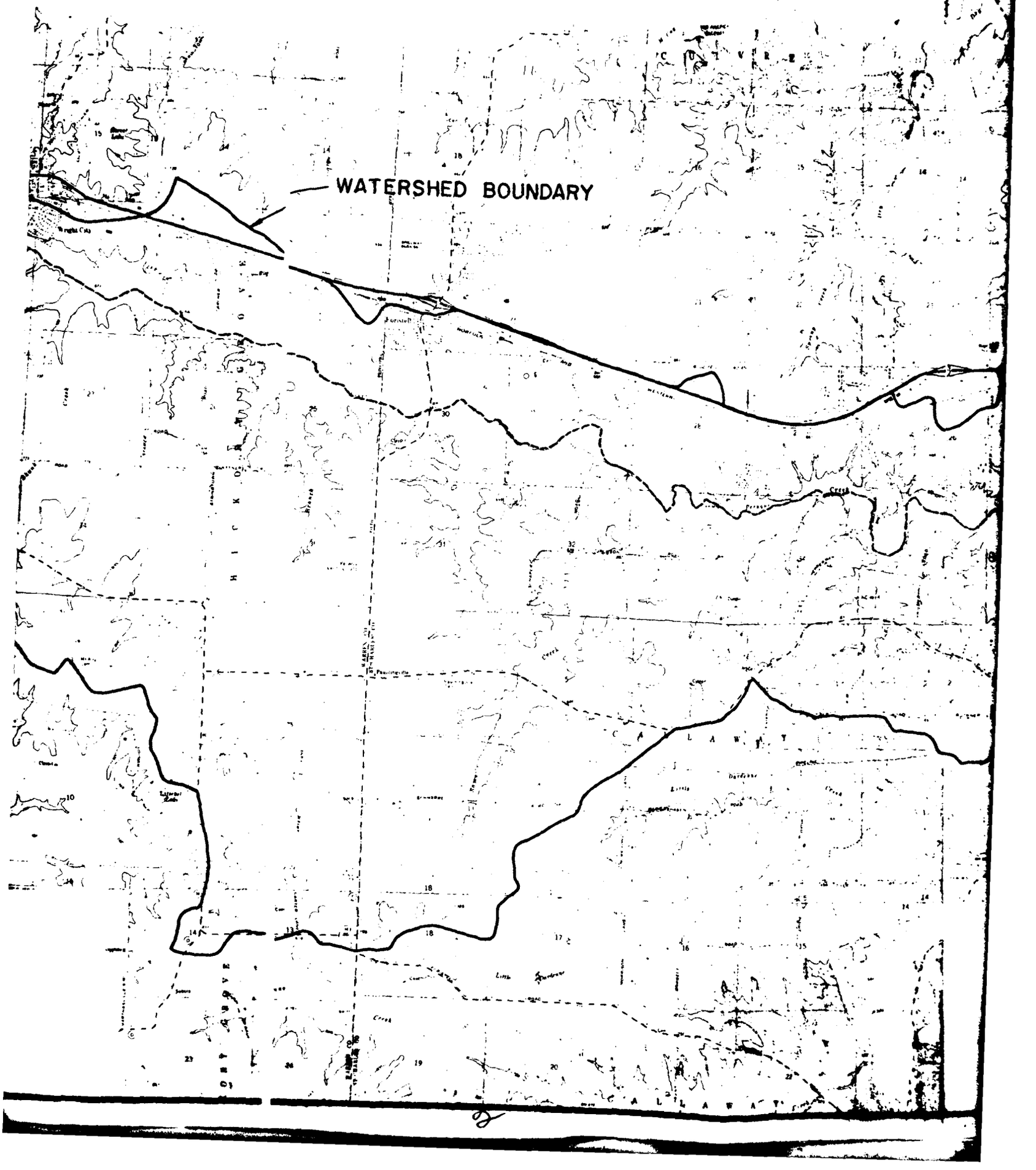
(6) The eroded earthen areas of the upstream and downstream faces of the dam should be restored and protected.

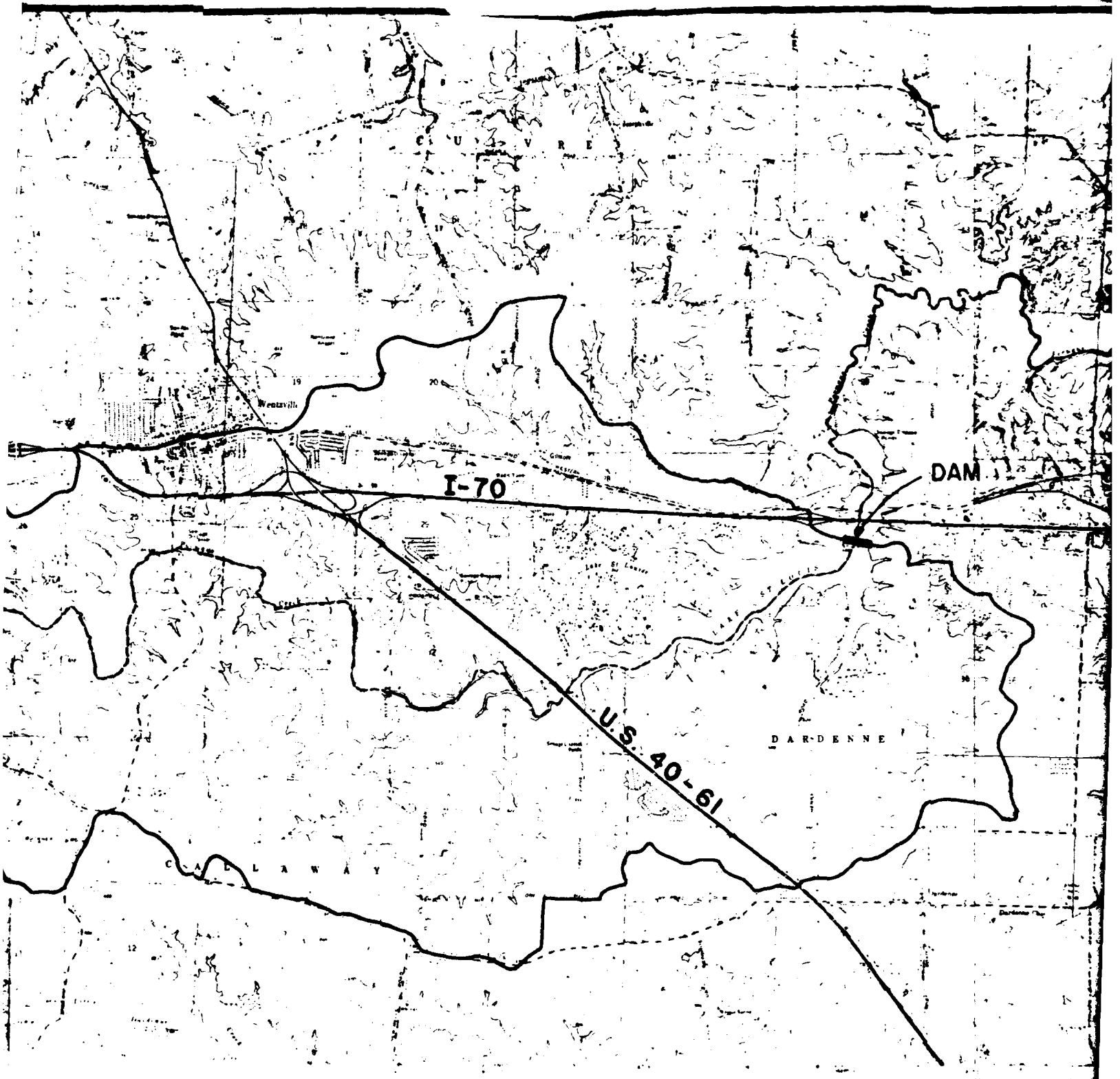
(7) The manually operated control gate on the 72-inch lake drawdown pipe should be operated to ensure proper function. At present, this gate leaks moderately, and unless for some reason the leak increases severely, should not impair the performance of the lake from a recreational standpoint.

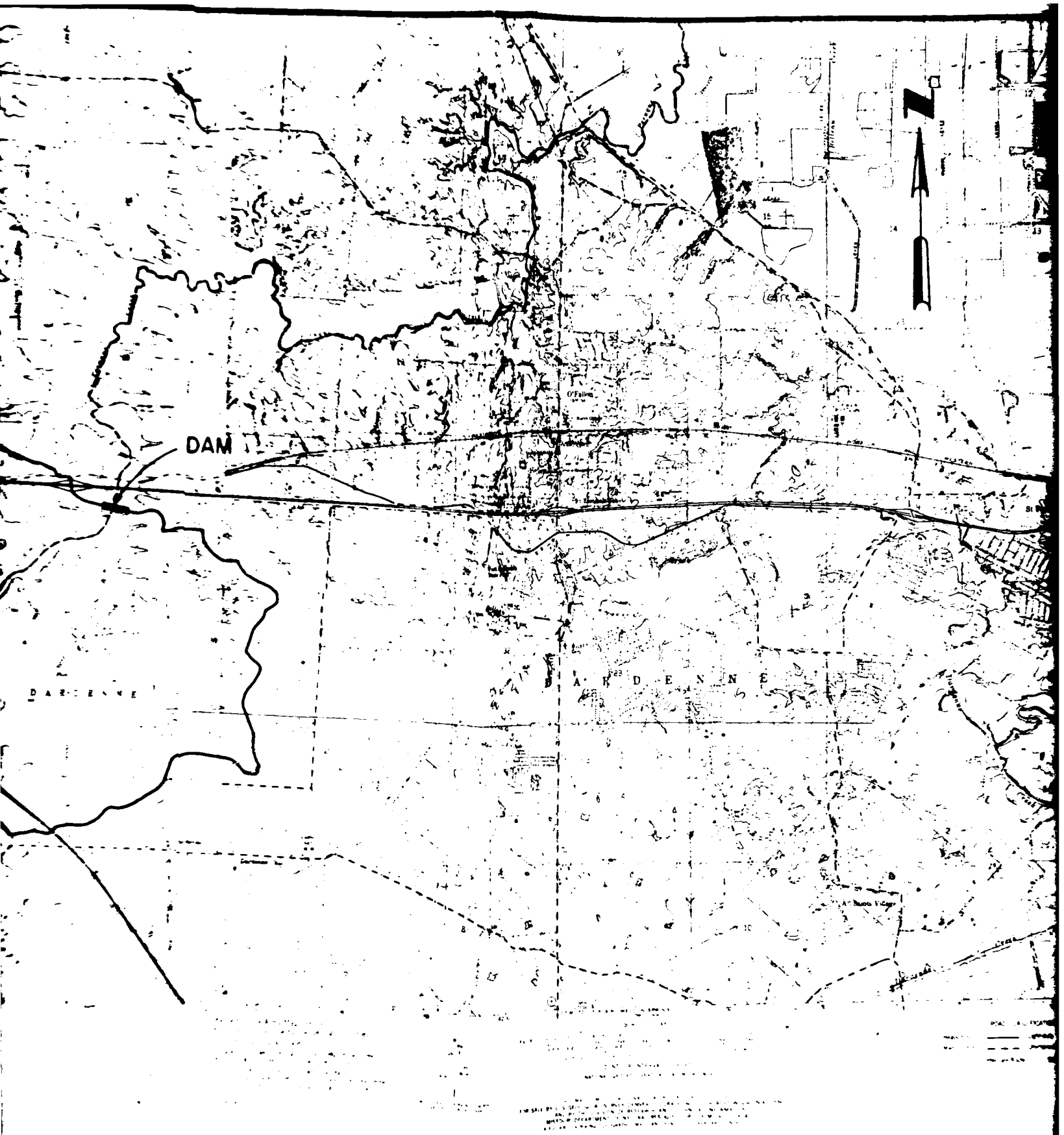
(8) It is recommended that the lake owners association continue to employ qualified personnel for the purpose of operating and maintaining the dam, spillway, and appurtenant features. Inspection of the dam and spillway should be continued, as at present, on a monthly basis. Records indicating the date of the inspection, the items inspected and their condition, the urgency of any action to be taken in the case where remedial work is deemed necessary, and any additional information considered pertinent should also be included. The names of personnel performing the inspection, should also be a matter of record. A copy of this inspection report should be submitted without delay to the lake owners association for further consideration. It is also recommended, for future reference, that records be kept of all inspections, maintenance work, remedial measures, and improvements.



LOCATION MAP


WATERSHED BOUNDARY

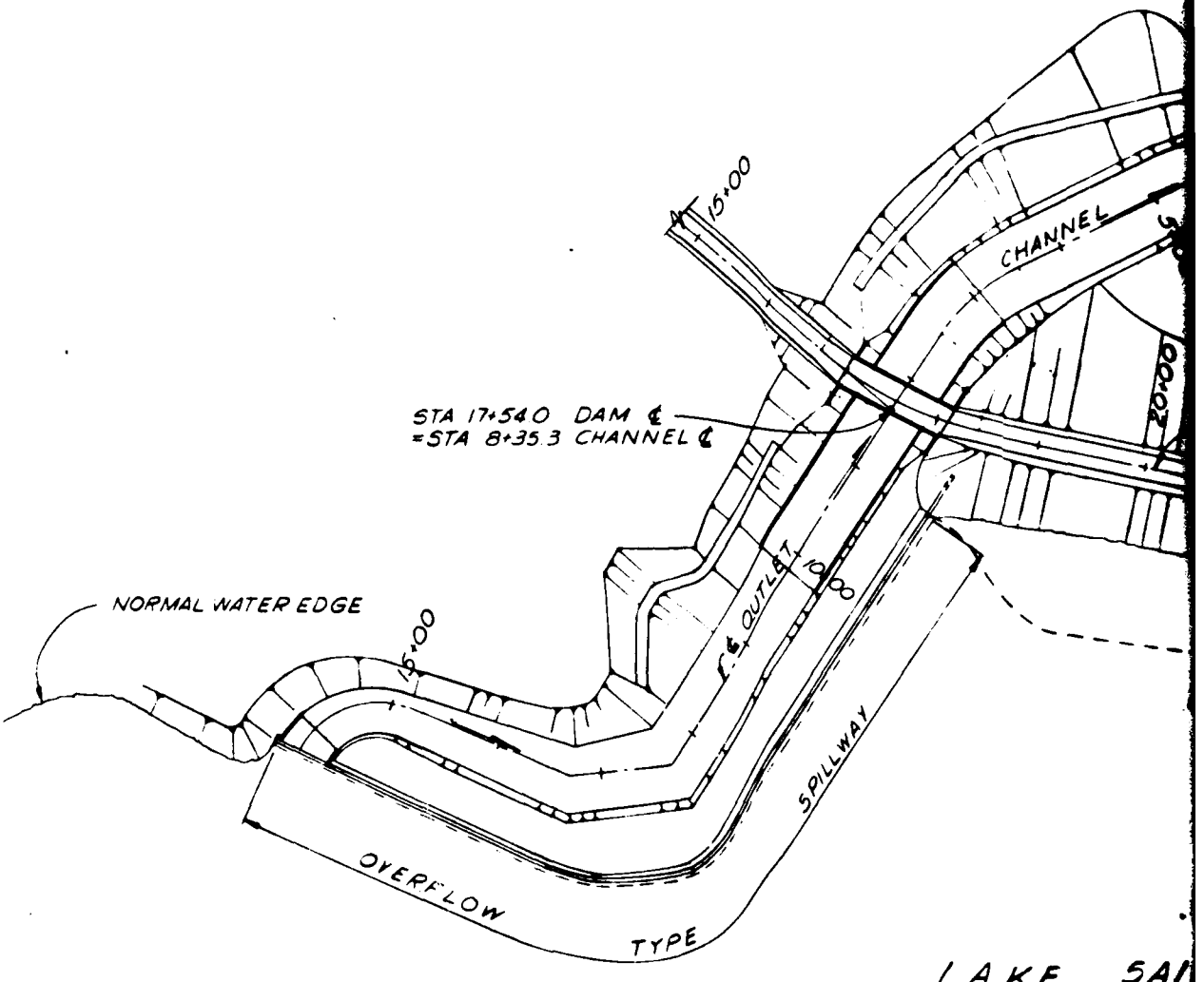

I-70
DAM
U.S. 40-61
DARDENNE
CLAWAY
Westville



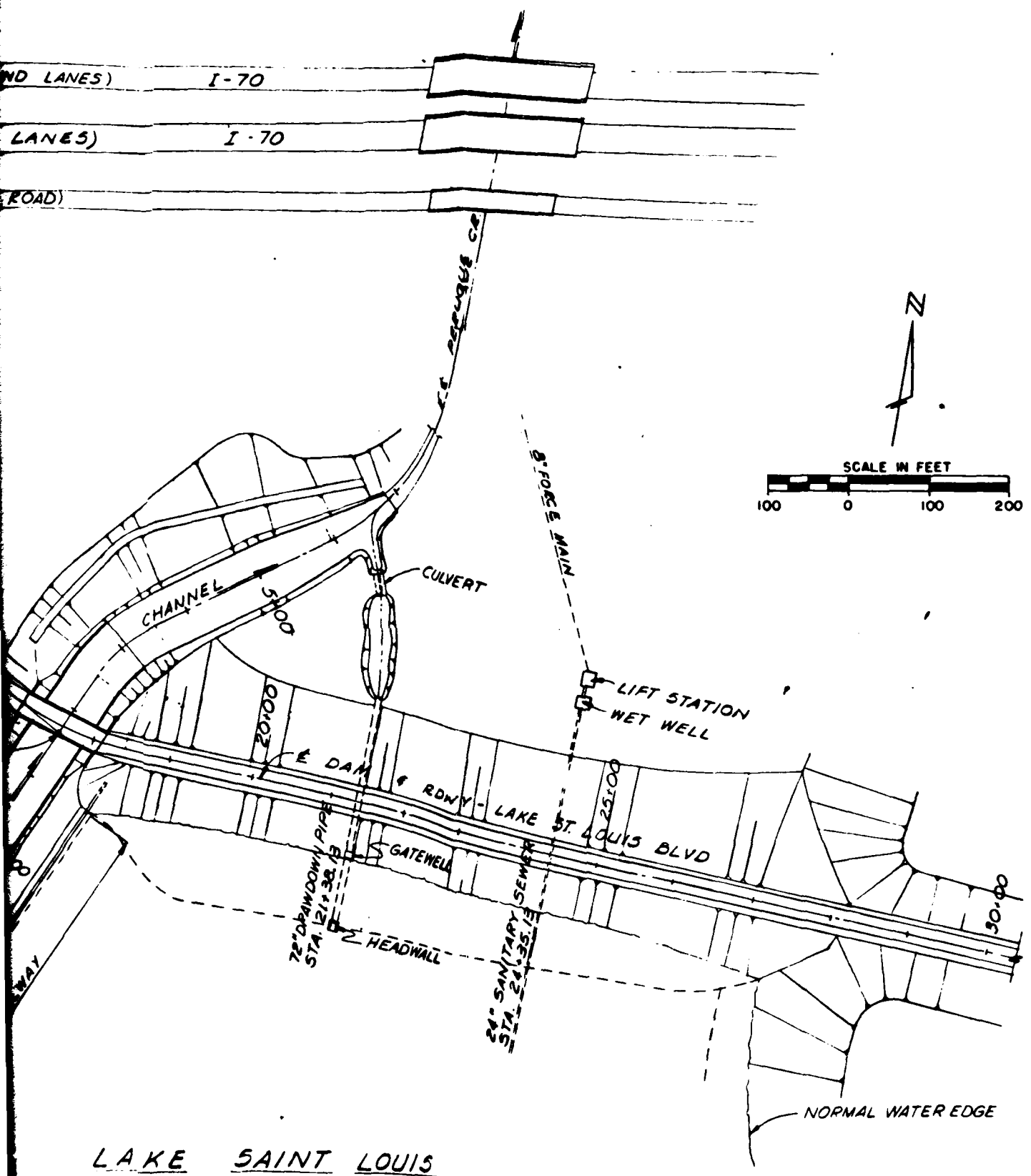
REGIONAL VICINITY MAP

4

PLATE


(WESTBOUND LANES) I-70
(EASTBOUND LANES) I-7
(SOUTH OUTER ROAD)
15+00
CHANNEL
20+00
STA 17+54.0 DAM ℄
=STA 8+35.3 CHANNEL ℄
NORMAL WATER EDGE
16+00
6'-6" OUTLET
10'-0"
SPILLWAY
OVERFLOW
TYPE

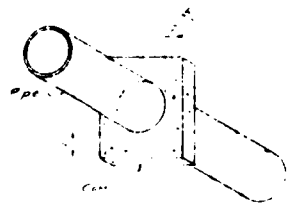
LAKE SAI



LAKE SAINT LOUIS

GENERAL PLAN OF DAM AND SPILLWAY

PLATE 2

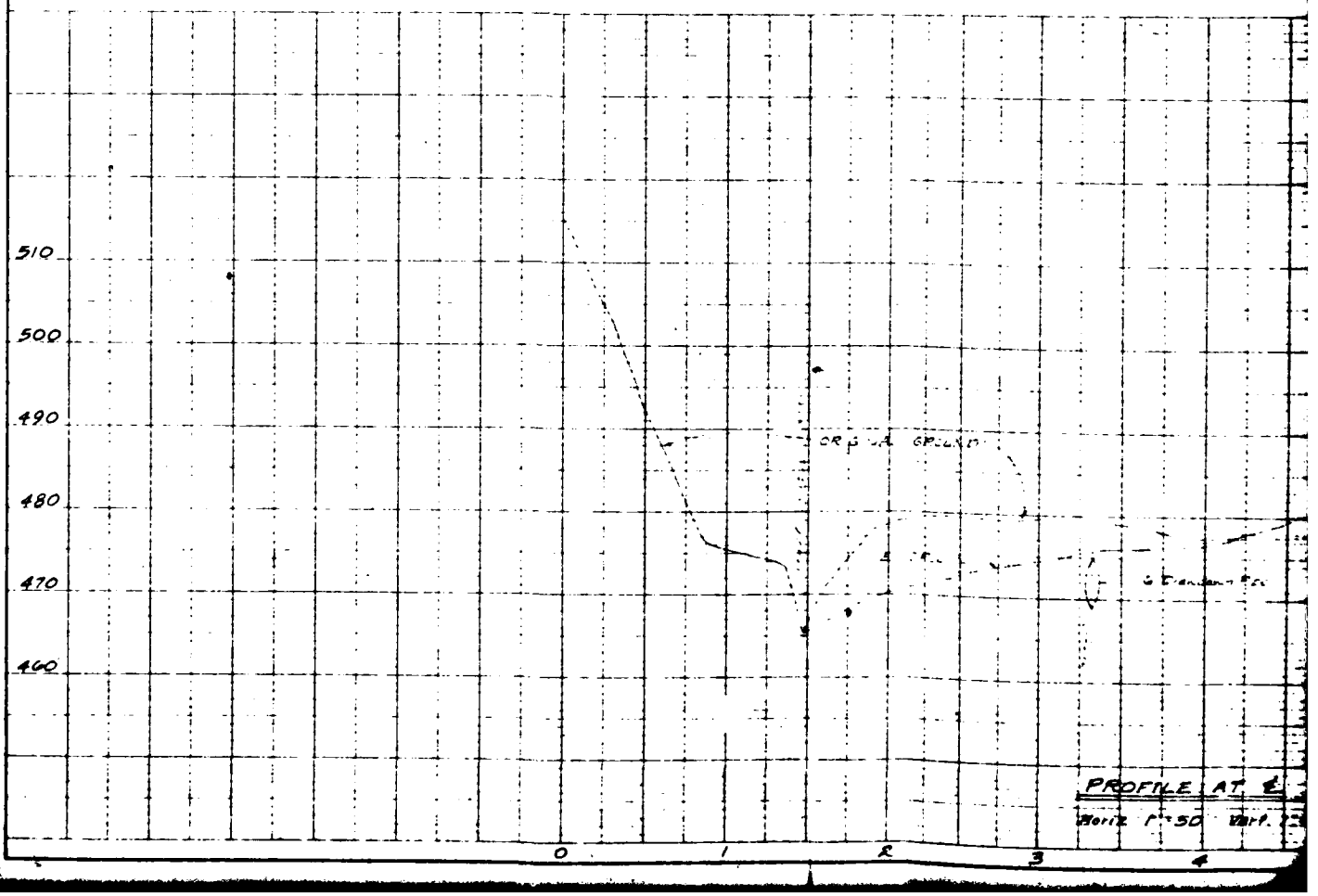


ANTI-SEEP

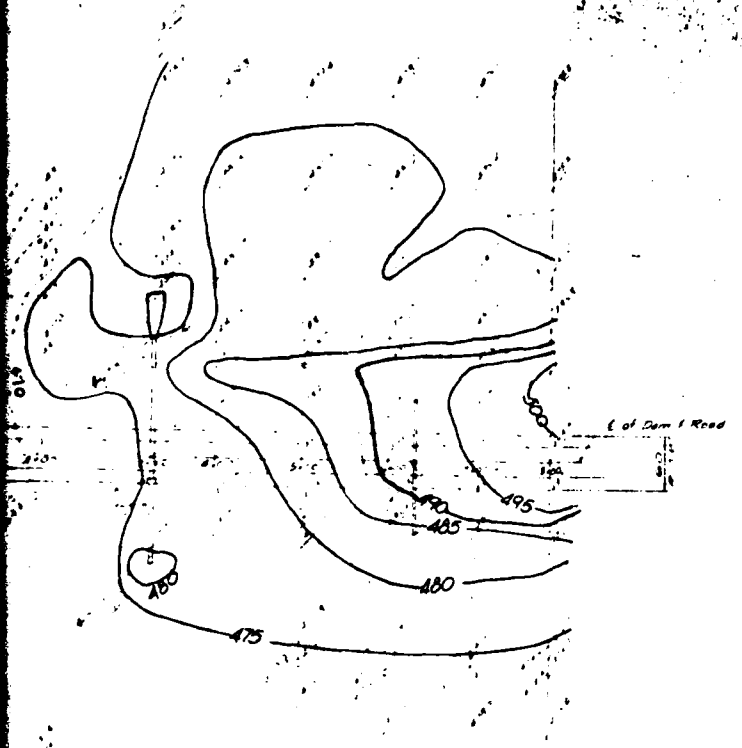
PLAN

PLAN VIEW OF ANTI SEEPS

PROFILE



PROFILE AT



PLAN VIEW OF DAM AREA

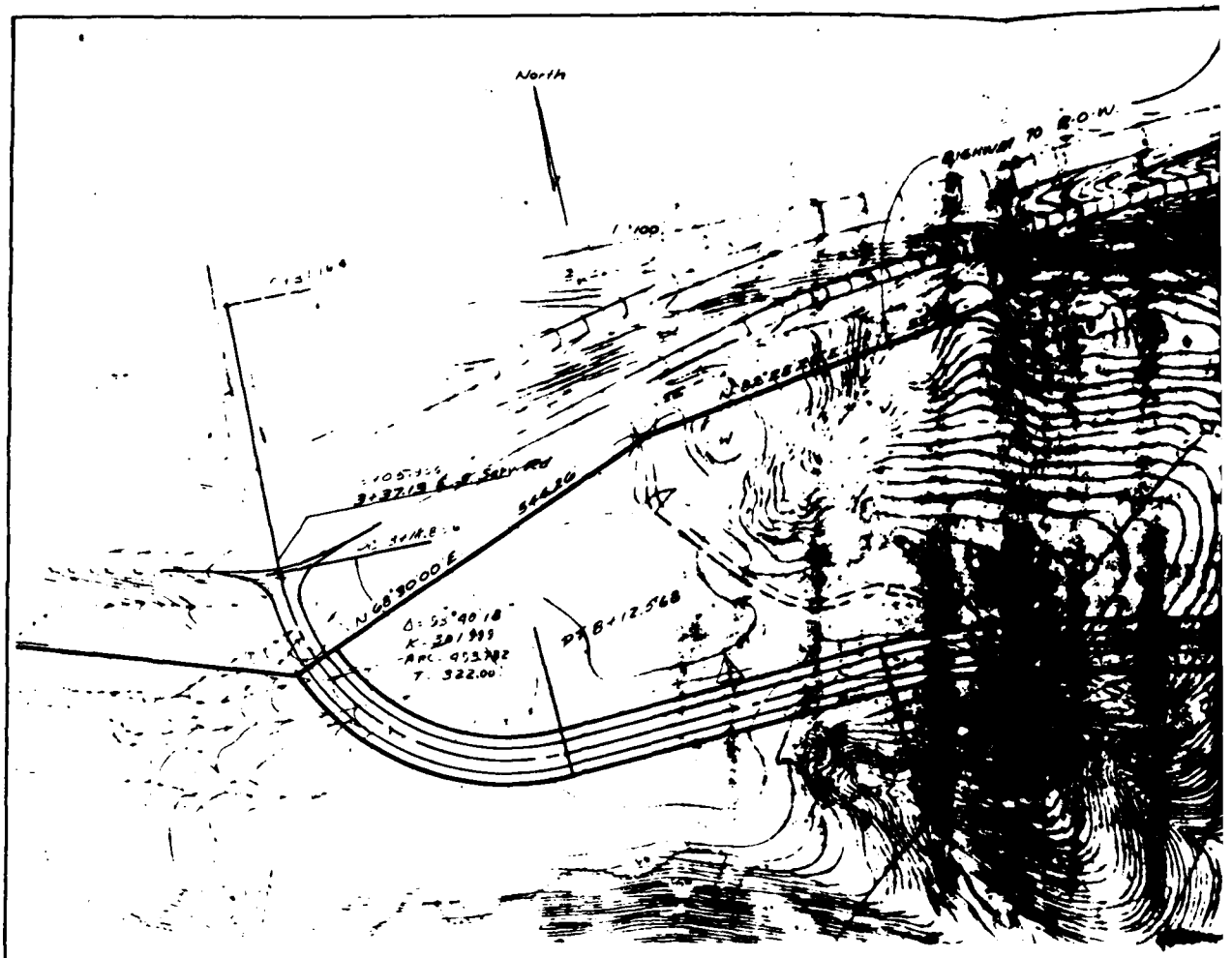
510
500
490
480
470
460

PLAN AND PROFILE OF DAM
PREPARED BY
LAKE SAINT LOUIS
JUNE 17, 1969

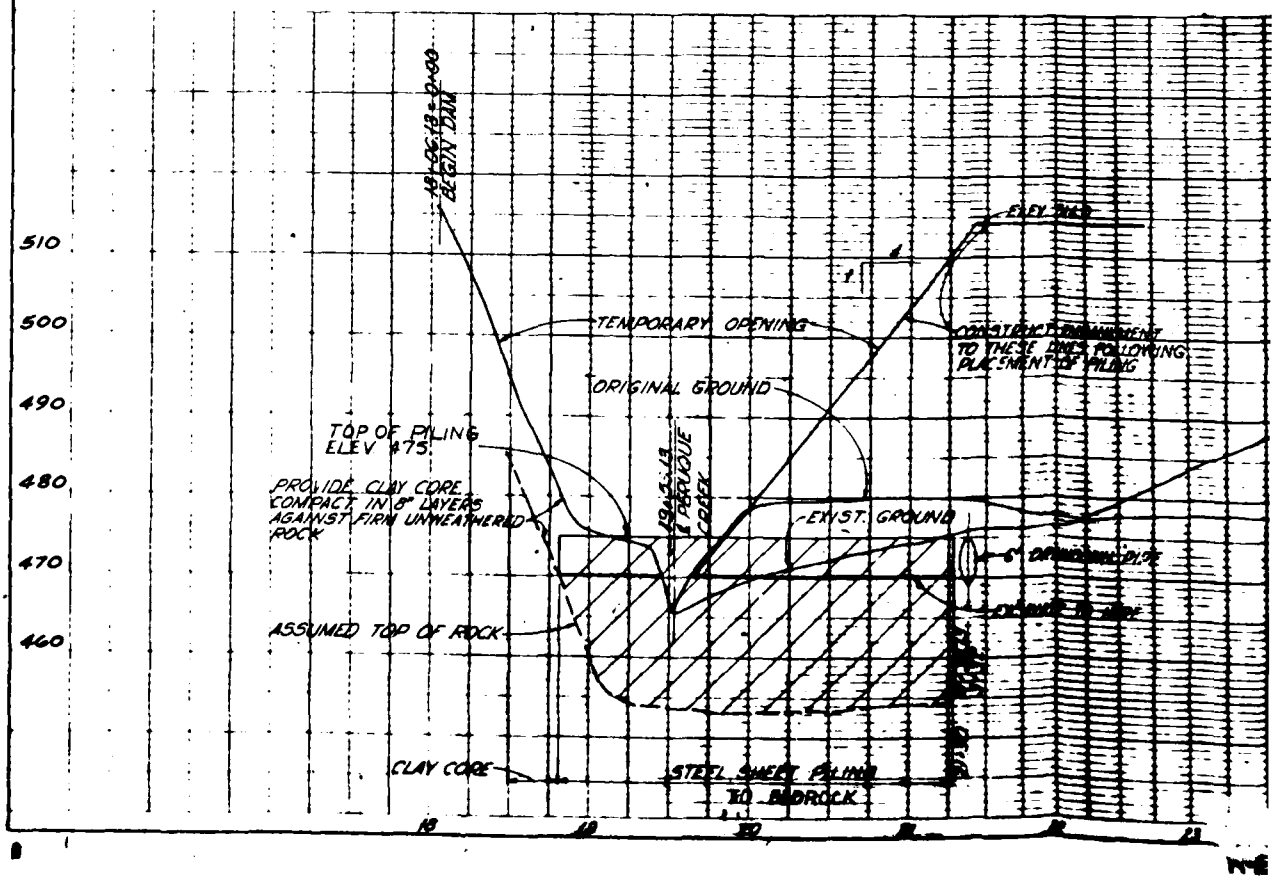
5 6 7 8 9

K+E PLATE 1 PLAN-PROFILE

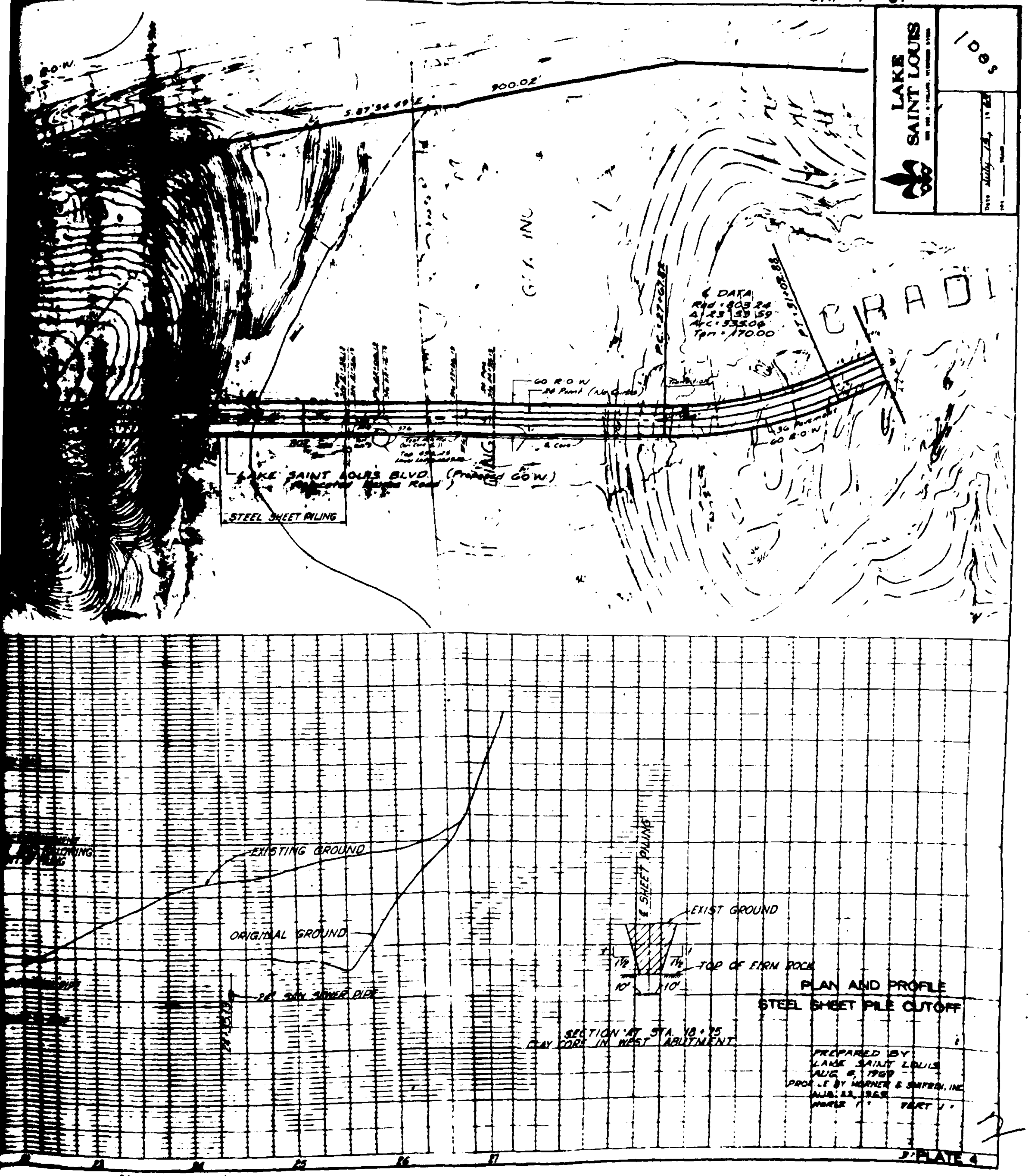
PLATE

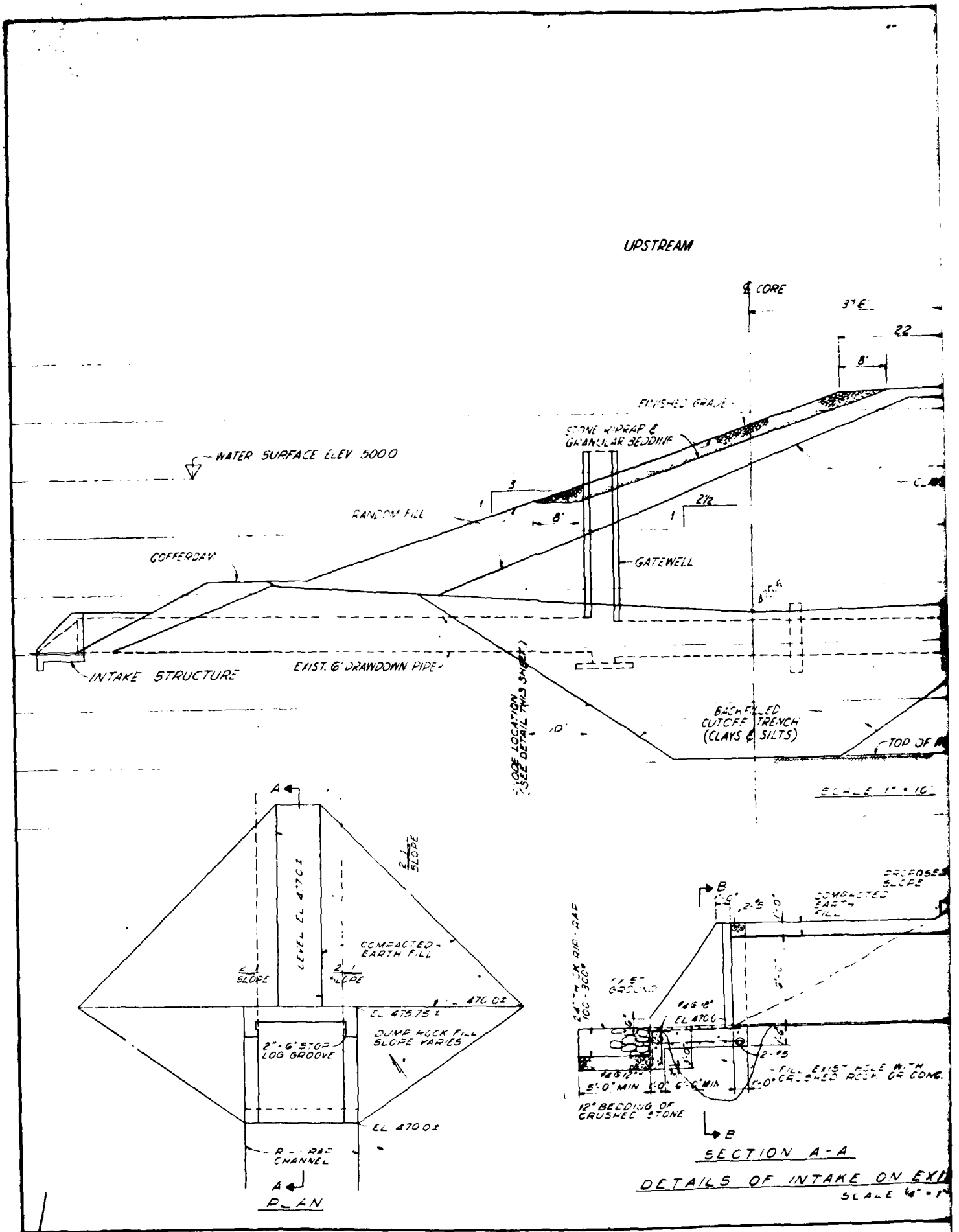

North
N 68°30'00 E
Δ = 55°40'18
K = 381.993
Arc = 953.782
T = 522.00
P.T. B+12.568
54+30

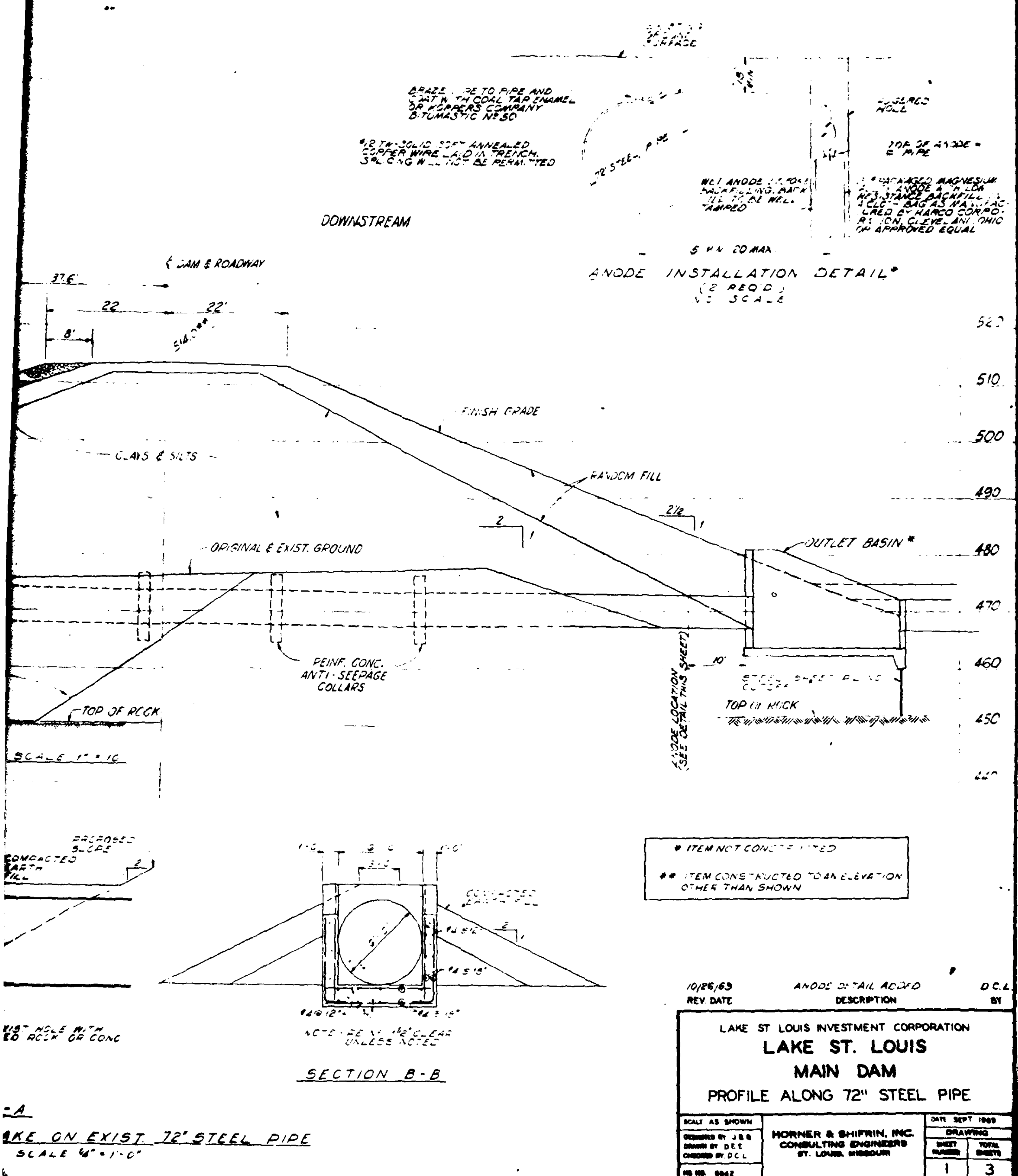
PROFILE


510
500
490
480
470
460
BEGIN DAM
TEMPORARY OPENING
ORIGINAL GROUND
TOP OF PILING
ELEV 475
PROVIDE CLAY CORE
COMPACT IN 8" LAYERS
AGAINST FIRM UNWEATHERED
ROCK
EXIST. GROUND
ASSUMED TOP OF ROCK
CLAY CORE
STEEL SHEET PILING
TO BEDROCK

SH. 1 OF


LAKE SAINT LOUIS
900.02'
€ DATA
Rad = 803.24
Arc = 335.06
Tan = 170.00
60 R.O.W
24 Pvmt (No Curbs)
36 Pavement
60 R.O.W
LAKE SAINT LOUIS BLVD. (Proposed 60 W.)
STEEL SHEET PILING
EXISTING GROUND
ORIGINAL GROUND
24" SAN SEWER PIPE
€ SHEET PILING
EXIST GROUND
TOP OF FIRM ROCK
SECTION AT STA. 18+75
CLAY CORE IN WEST ABUTMENT
PLAN AND PROFILE
STEEL SHEET PILE CUTOFF
PREPARED BY
LAKE SAINT LOUIS
AUG 6, 1969
PLATE 4


UPSTREAM
℄ CORE
37'-6"
22'
8'
FINISHED GRADE
STONE RIPRAP & GRANULAR BEDDING
WATER SURFACE ELEV. 5000
3
1
RANDOM FILL
8'
2½
1
GATEWELL
COFFERDAM
INTAKE STRUCTURE
EXIST. 6' DRAWDOWN PIPE
(SEE DETAIL THIS SHEET)
BACKFILLED CUTOFF TRENCH (CLAYS & SILTS)
TOP OF
SCALE 1" = 10'
A
LEVEL EL 477.0 ±
2:1 SLOPE
COMPACTED EARTH FILL
2:1 SLOPE
EL 475.75 ±
EL 470.0 ±
2"x6" STOP LOG GROOVE
DUMP ROCK FILL SLOPE VARIES
EL 470.0 ±
RIPRAP CHANNEL
A
PLAN
B
1'-6"
2:1
10'-0"
COMPACTED EARTH FILL
EXPOSED SLOPE
EXIST GROUND
#6 @ 18"
EL 470.0
2-#8
#6 @ 12"
5'-0" MIN
1'-0"
6'-0" MIN
FILL EXIST HOLE WITH CRUSHED ROCK OR CONC.
12" BEDDING OF CRUSHED STONE
B
SECTION A-A
DETAILS OF INTAKE ON EXI
SCALE



REV. DATE	DESCRIPTION	BY
10/26/69	ANODE DETAIL ADDED	D.C.L.

LAKE ST LOUIS INVESTMENT CORPORATION

LAKE ST. LOUIS

MAIN DAM

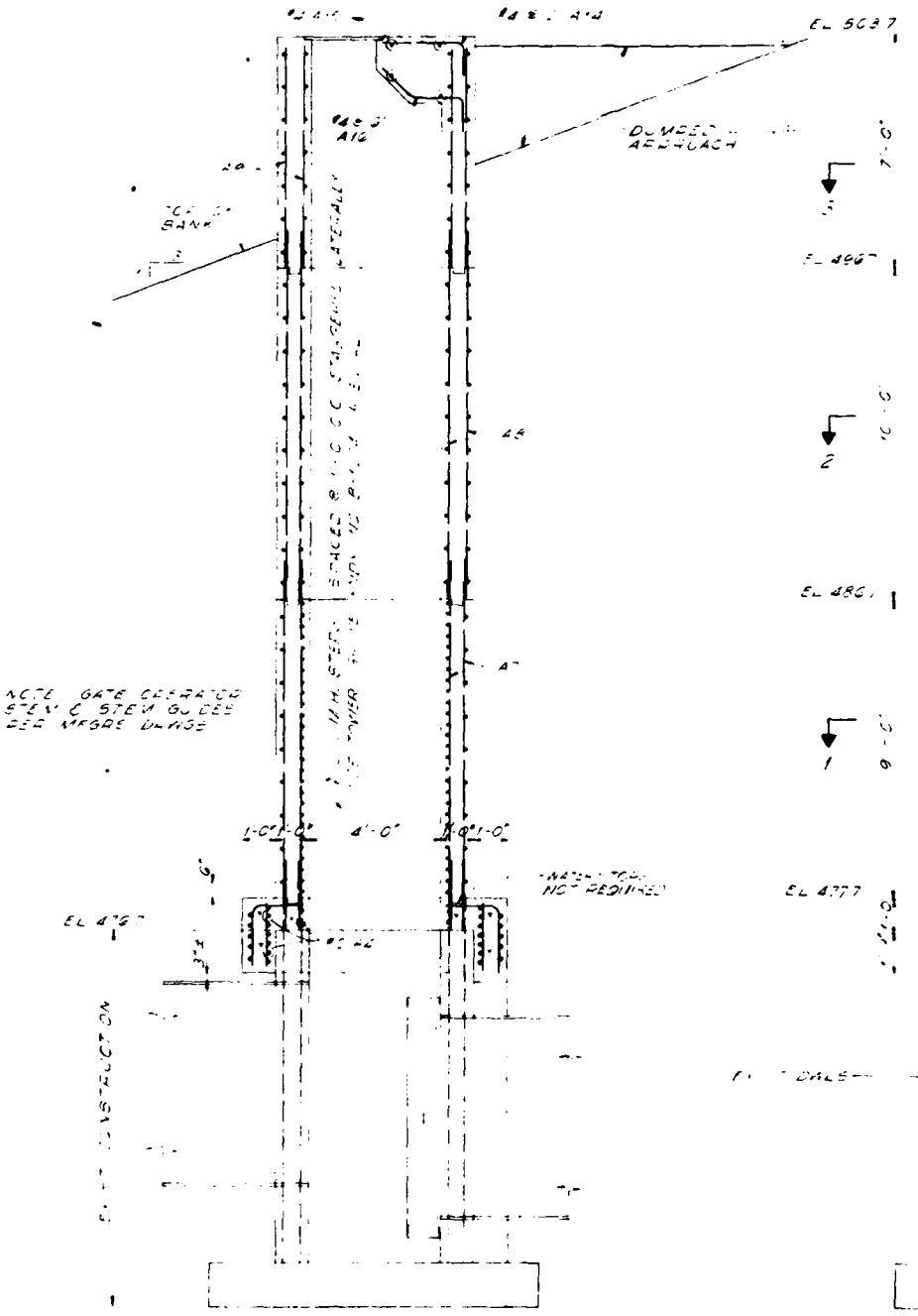
PROFILE ALONG 72" STEEL PIPE

SCALE AS SHOWN
DESIGNED BY J.B.B.
DRAWN BY D.E.E.
CHECKED BY D.C.L.
H&S NO. 6842

HORNER & SHIFRIN, INC.
CONSULTING ENGINEERS
ST. LOUIS, MISSOURI

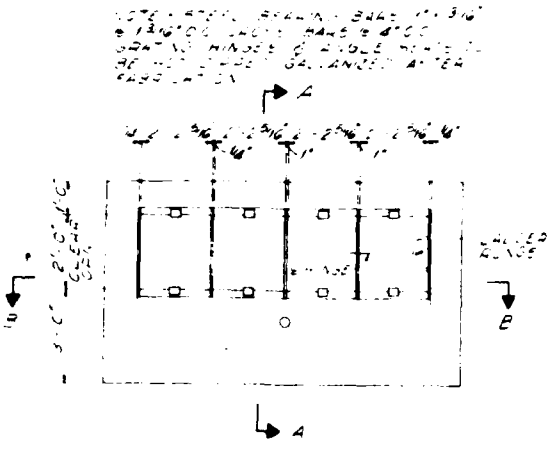
DATE SEPT 1969
DRAWING SHEET NUMBER 1 — TOTAL SHEETS 3

PLATE 5



SECTION A-A

SECTION B-B
SCALE 3/8"=1'-0"



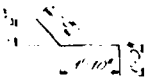
PLAN OF TOP SLAB

SCALE 3/8" = 1'-0"

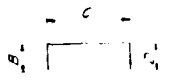
BAR SCHEDULE

MARK	SIZE	QUANTITY	LENGTH	TYPE	C	B	D
A1	6	10		17	12-8	3-9	3-9
A2	4	42		17	1-11	1-8	—
A3	4	42	1-11	1			
A4	6	18	12-8	1			
A5	4	60	2-2	1			
A6	6	6	7-8	1			
A7	4	60	10-2	1			
A8	4	60	11-2	1			
A9	4	60	6-10	1			
A10	6	52	5-8	1			
A11	6	30	10-8	1			
A12	6	34	10-8	1			
A13	5	16	6-10	1			
A14	4	17	3-6	17	1-0	2-6	—
A15	4	4	10-6	1			
A16	4	17	4-5	1			
A17	6	52	18-2	17	10-8	3-9	3-9

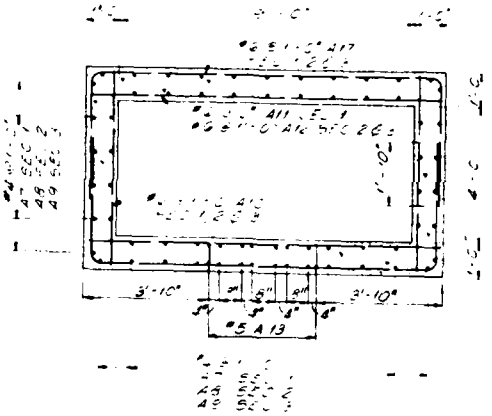
NOTE - TYPE 1 BARS ARE STRAIGHT BARS



A14 BAR

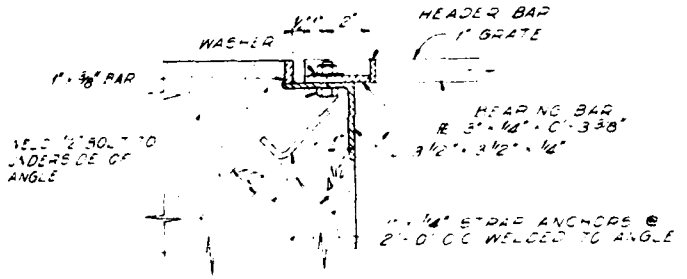


TYPE 17



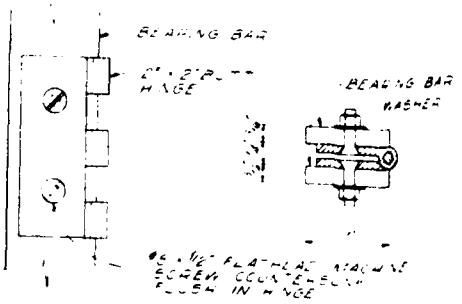
TYPICAL SHAFT SECTIONS

SCALE 3/8" = 1'-0"



DETAIL OF GRATE CLAMP & ANGLE SEAT

SCALE 3" = 1'-0"



GRATE HINGE

FULL SIZE

SECTION B-B

SCALE 3/8" = 1'-0"

3/15/69 REV. DATE	BAR SCHEDULE REVISION A5, A11, A13 DESCRIPTION	D.C.L. BY

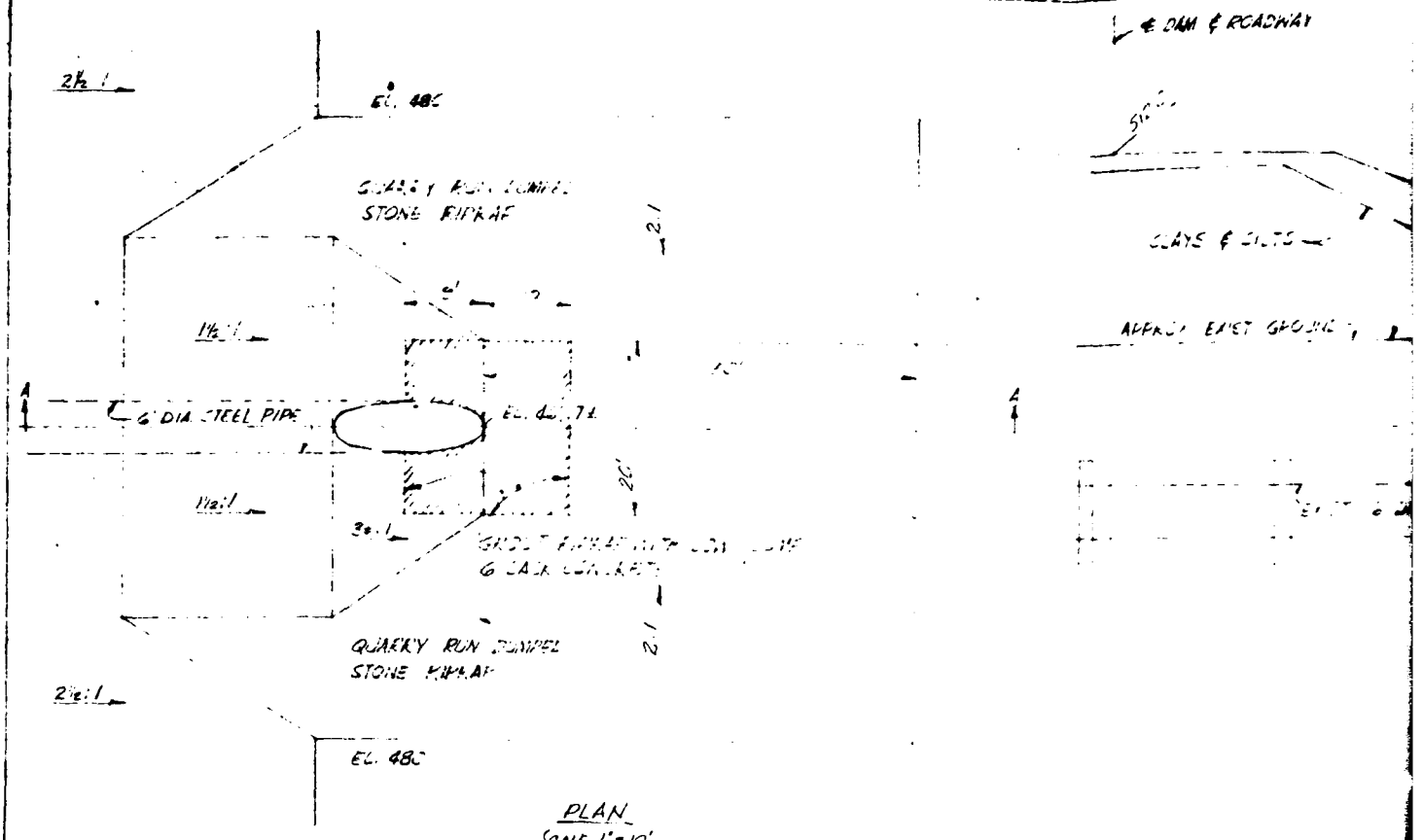
LAKE ST LOUIS INVESTMENT CORPORATION

LAKE ST. LOUIS MAIN DAM

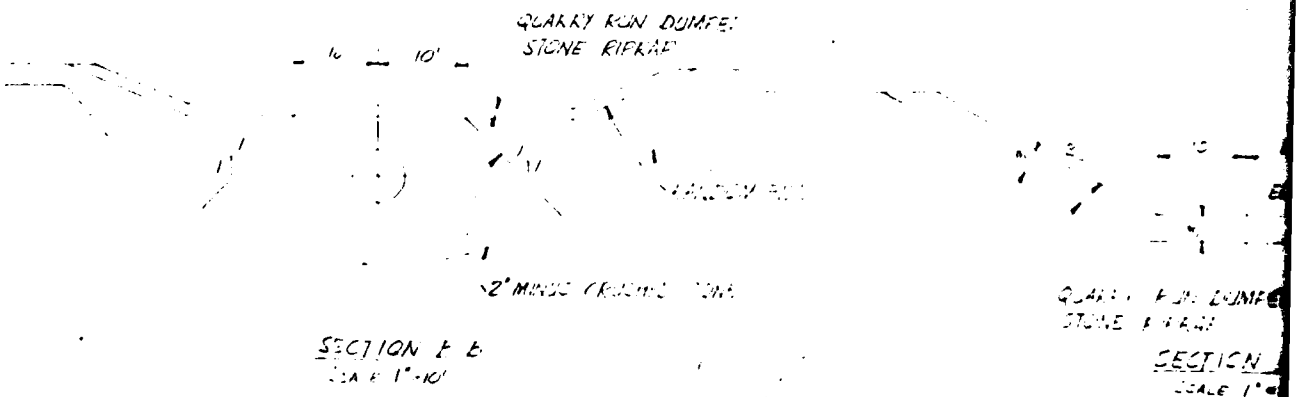
DETAILS-GATEWELL STRUCTURE

SCALE AS SHOWN	HORNER & SHIFRIN, INC. CONSULTING ENGINEERS ST LOUIS MISSOURI	DATE SEPT 1968 DRAWING
DESIGNED BY J.B.S. DRAWN BY D.E.E. CHECKED BY D.C.L.		SHEET NUMBER 2 / TOTAL SHEETS 3
HS NO 6942		

PLATE 6



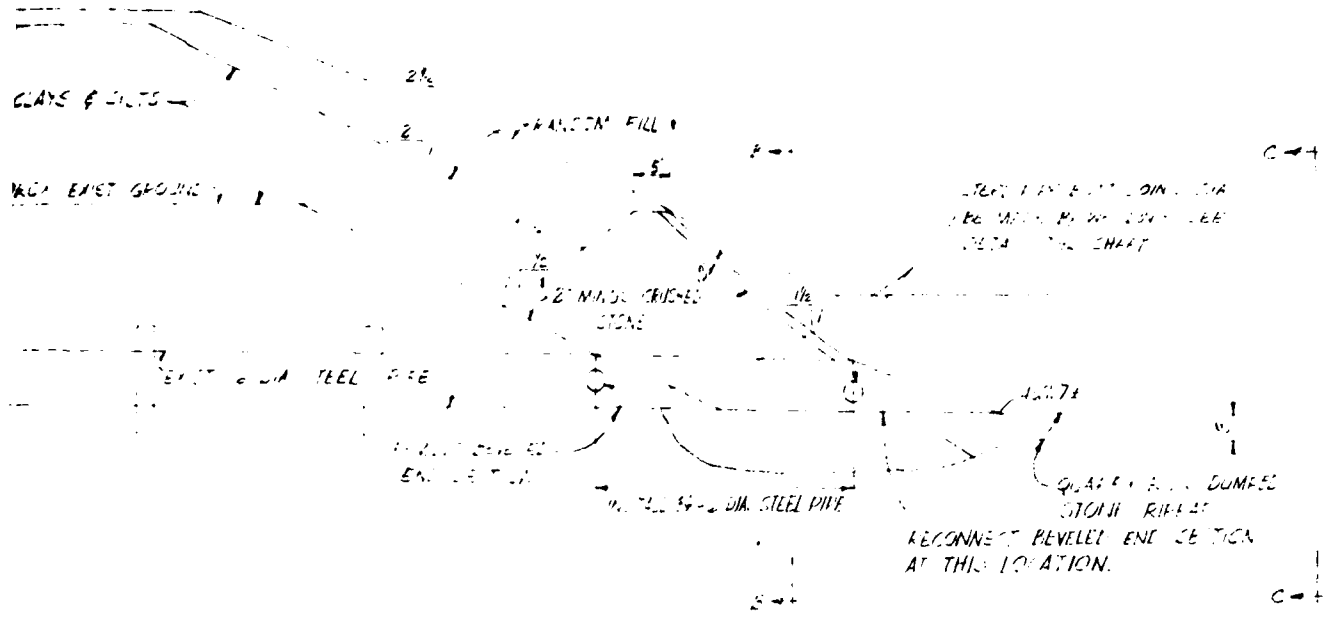
PLAN
SCALE 1"=10'



SECTION E-E
SCALE 1"=10'

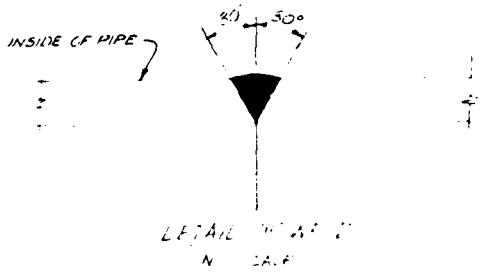
SECTION
SCALE 1"=

DAM & ROADWAY



SECTION A-A
SCALE 1" = 5'

CUT END OF PIPE AND GRIND AS REQUIRED TO 30° BEVEL TO PROVIDE DOUBLE BEVEL WELD FULL PENETRATION.



DETAIL "A"
NO SCALE

QUARRY RUN DUMPED STONE RIP-RAP

SECTION C-C
SCALE 1" = 10'

LAKE SAINT LOUIS INVESTMENT CORPORATION

LAKE ST. LOUIS MAIN DAM

MODIFICATION TO 6' PIPE OUTLET

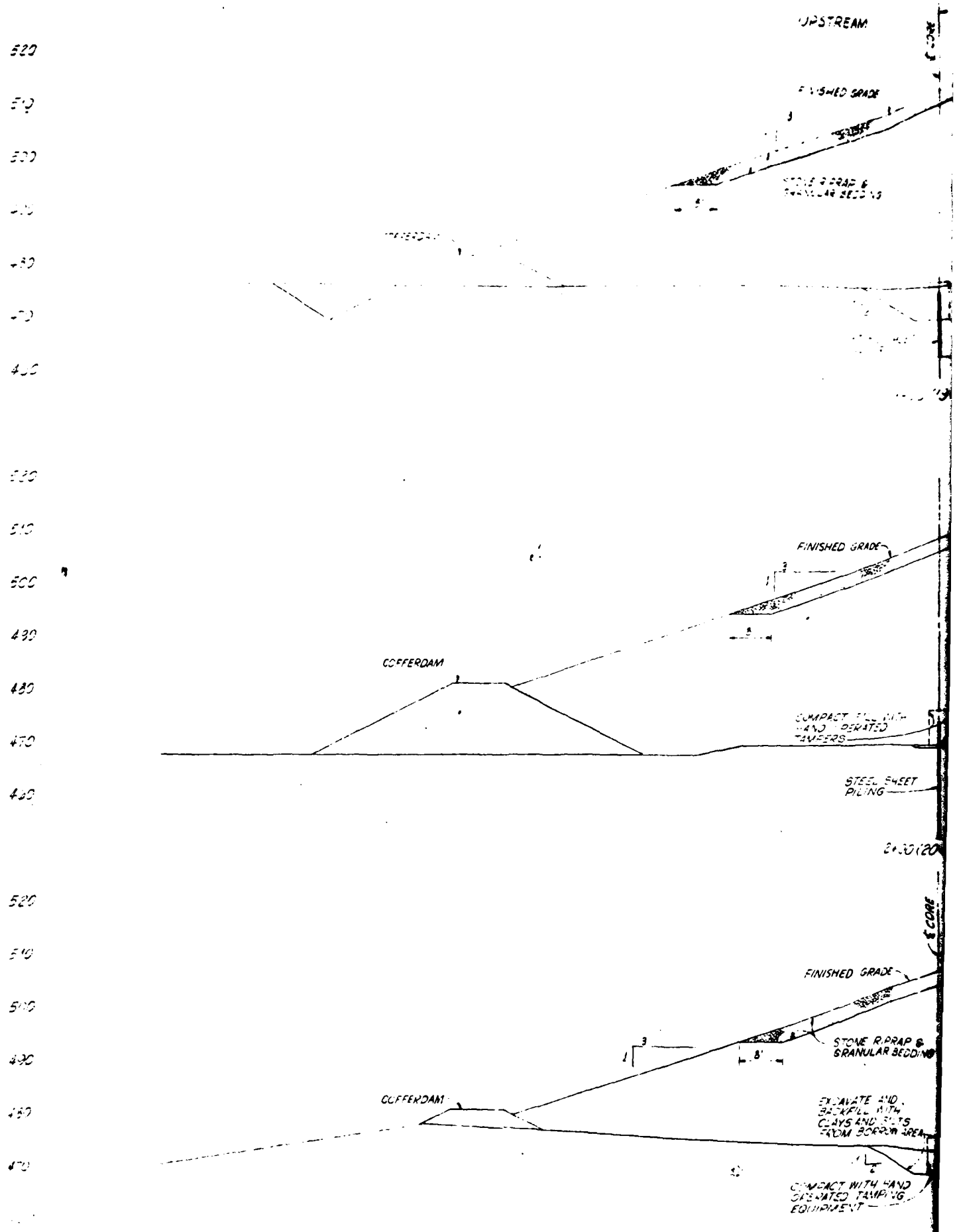
STATE OF MISSOURI
DONALD C. LOCHMOELLER
NUMBER E-9240
REGISTERED PROFESSIONAL ENGINEER

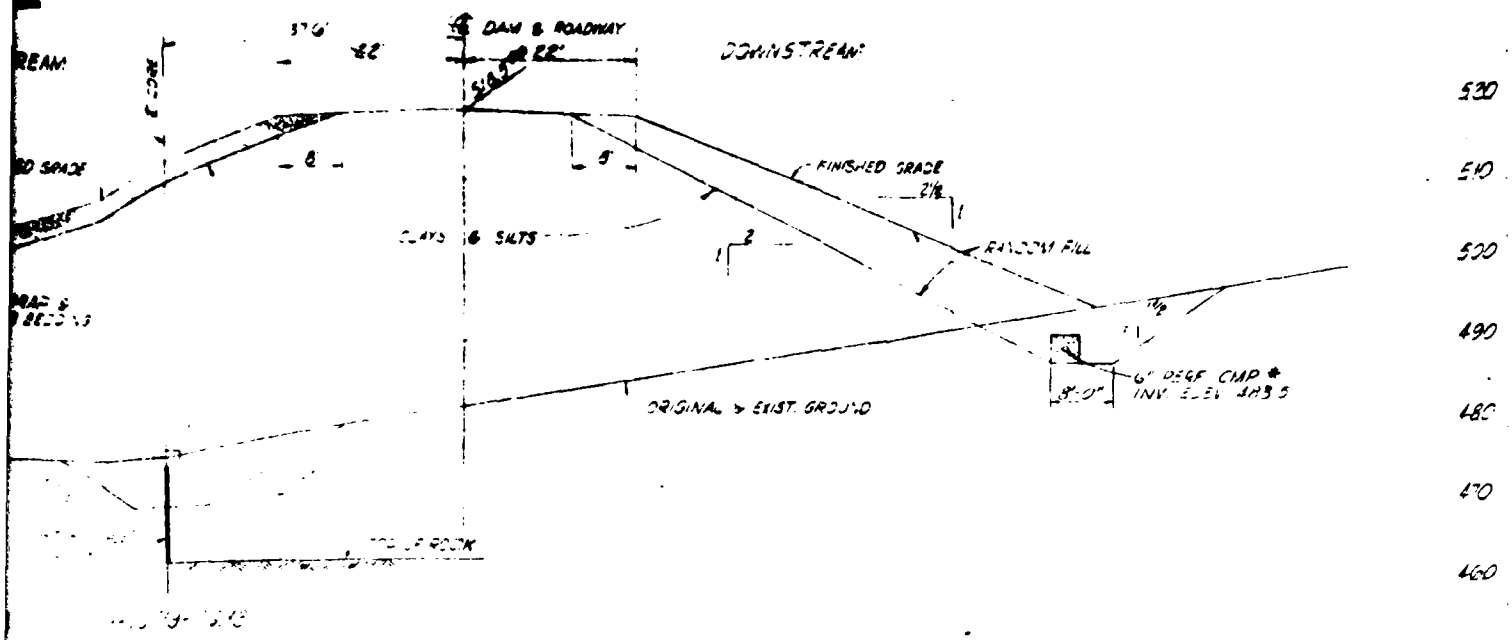
SCALE AS NOTED
DESIGNED
DRAWN BY
CHECKED BY
HS NO 6842

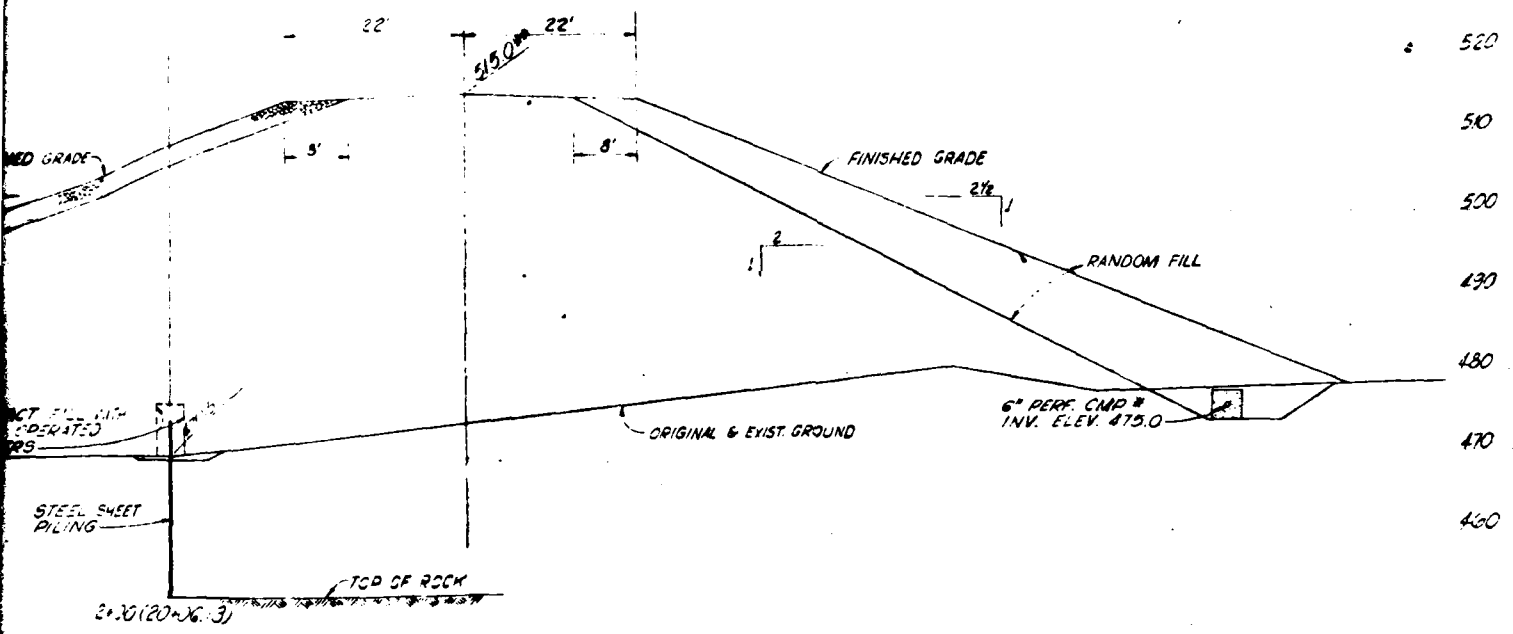
HORNER & SHIFRIN, INC
CONSULTING ENGINEERS
ST LOUIS, MISSOURI

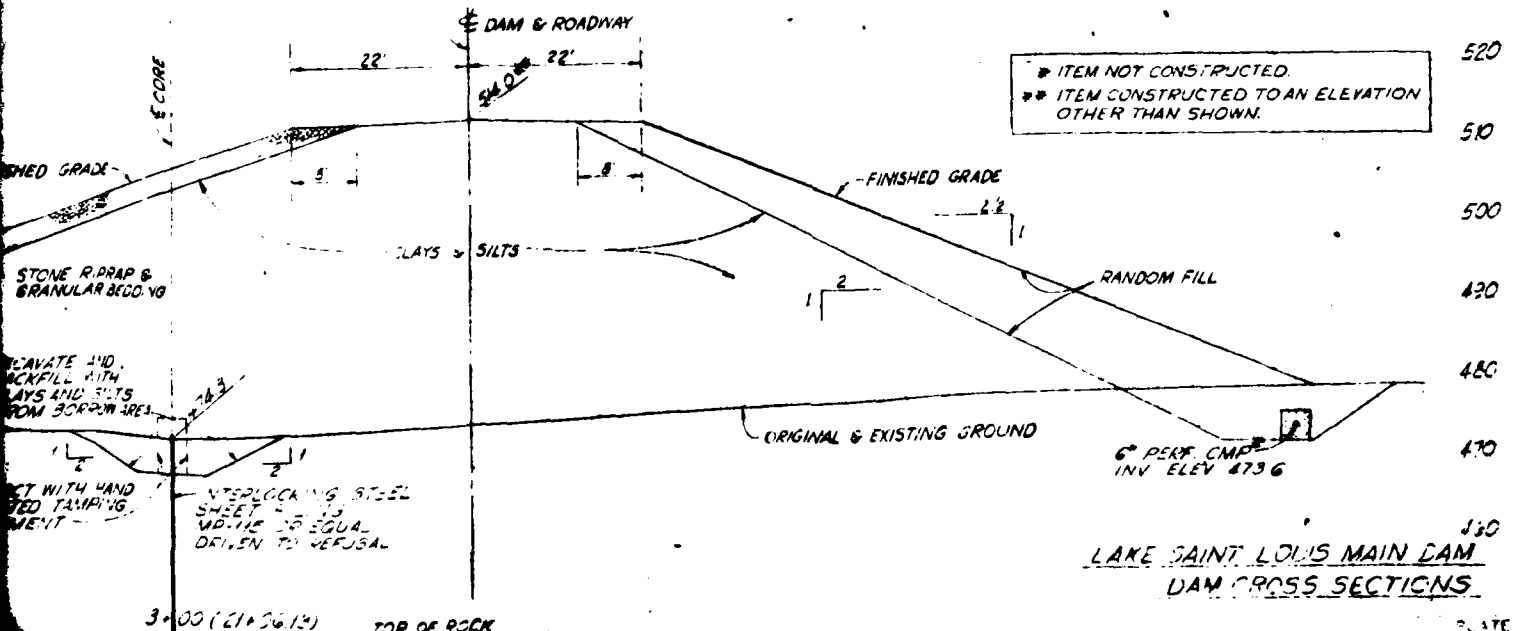
DATE JUNE, 1978
DRAWING SHEET NUMBER 24
TOTAL SHEETS 29

PLATE


UPSTREAM
FINISHED GRADE
STONE RIPRAP & GRANULAR BEDDING
COFFERDAM
FINISHED GRADE
COFFERDAM
STEEL SHEET PILING
FINISHED GRADE
STONE RIPRAP & GRANULAR BEDDING
COFFERDAM
EXCAVATE AND BACKFILL WITH CLAYS AND SILTS FROM BORROW AREA
COMPACT WITH HAND OPERATED TAMPING EQUIPMENT



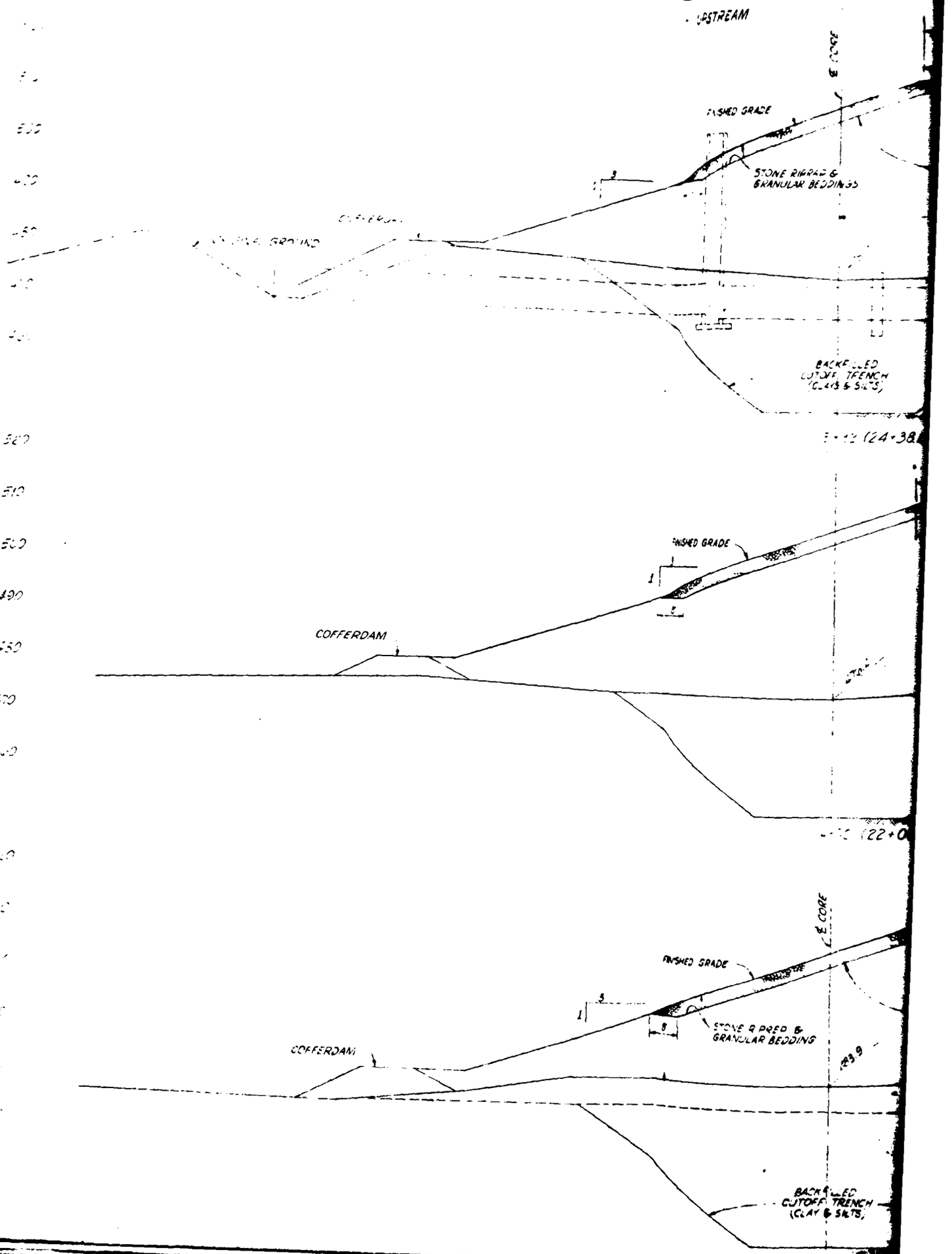


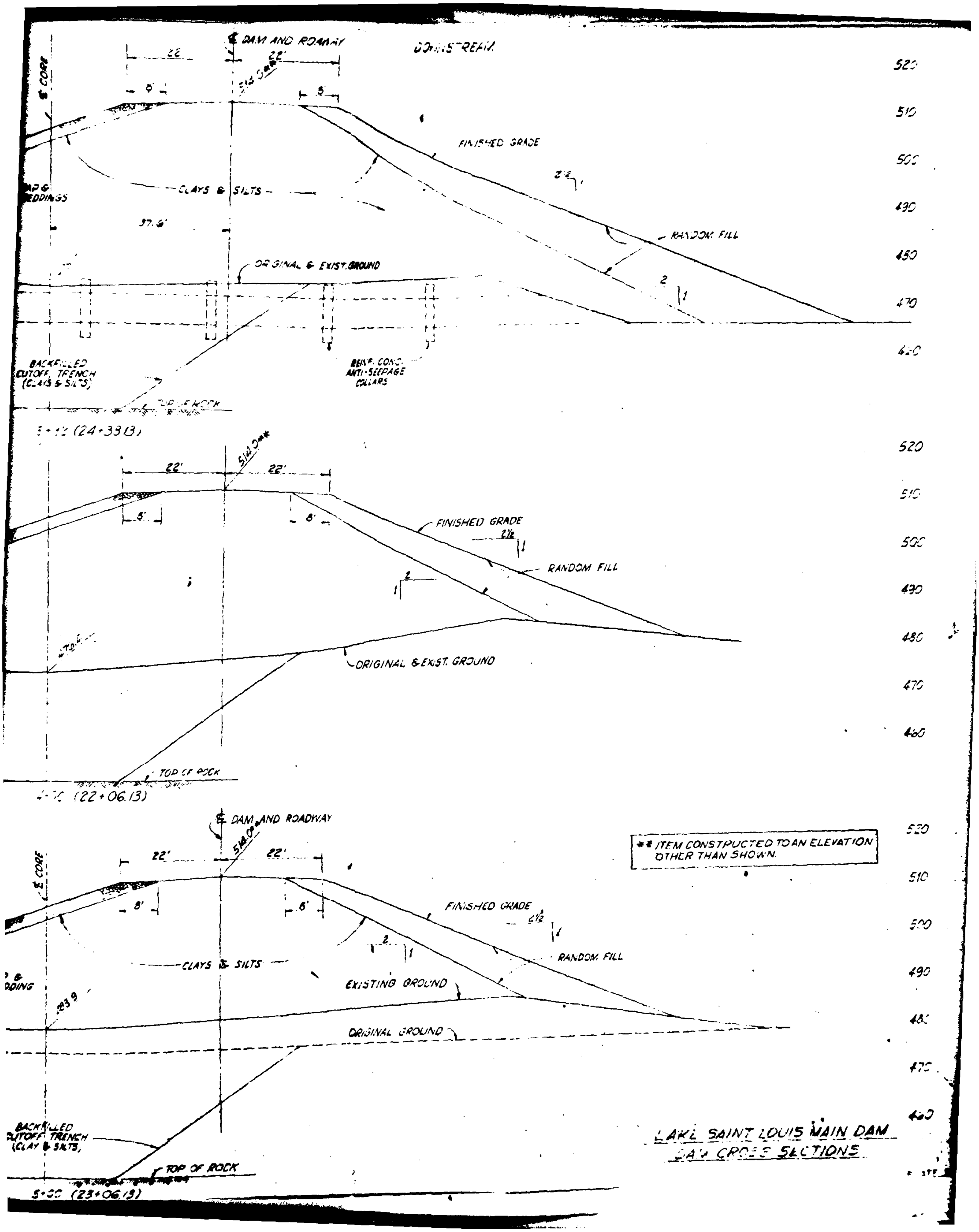


LAKE SAINT LOUIS MAIN DAM

DAM CROSS SECTIONS

PLATE


UPSTREAM
FINISHED GRADE
STONE RIPRAP & GRANULAR BEDDING
BACKFILLED CUTOFF TRENCH (CLAYS & SILTS)
FINISHED GRADE
COFFERDAM
FINISHED GRADE
STONE RIPRAP & GRANULAR BEDDING
COFFERDAM
BACKFILLED CUTOFF TRENCH (CLAY & SILTS)



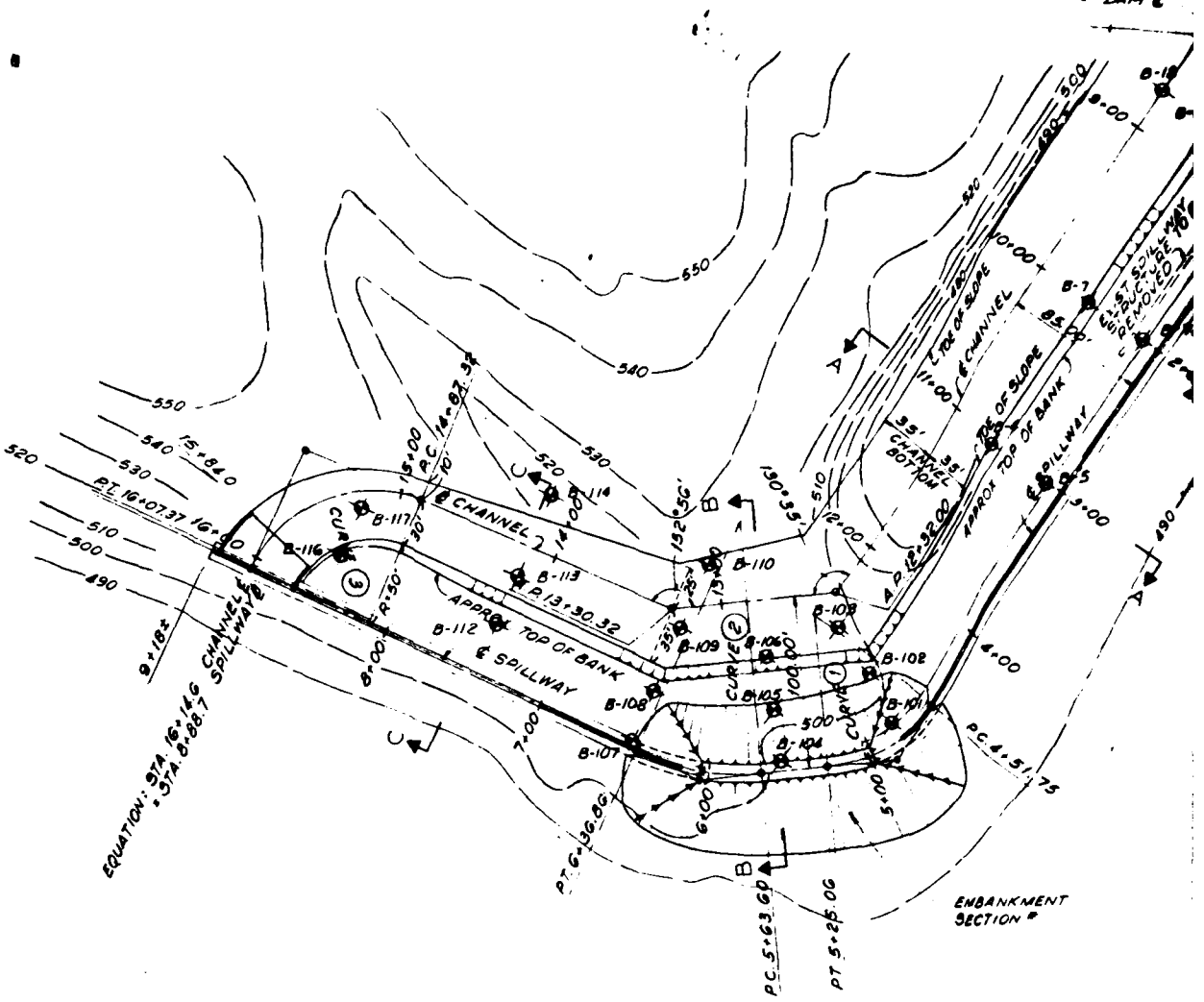
LAKE SAINT LOUIS MAIN DAM

DAM CROSS SECTIONS

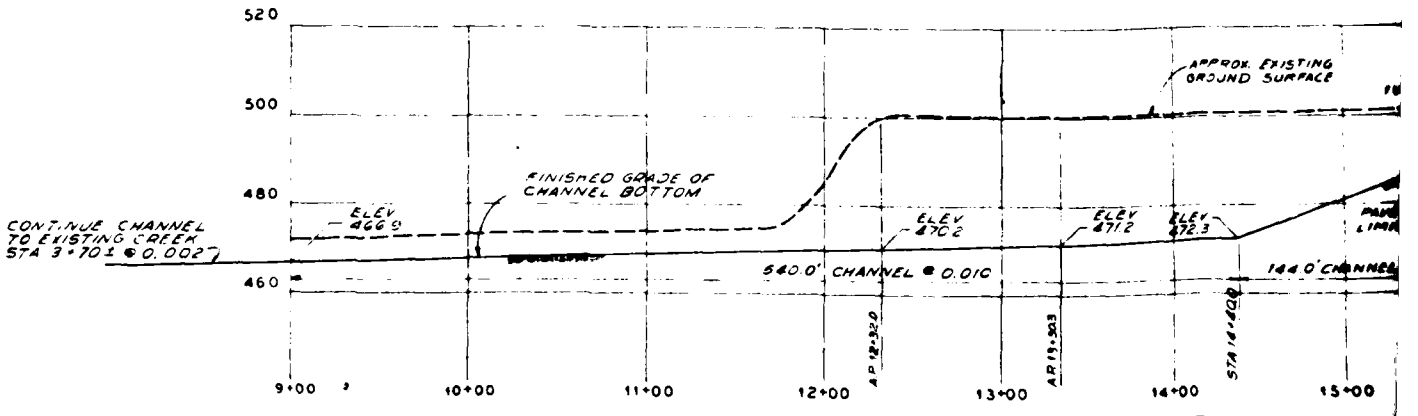
CURVE (1)
Δ = 49°25'00"
R = 85.00'
T = 39.11'
L = 73.31'

CURVE (2)
Δ = 27°27'20"
R = 152.88'
T = 37.34'
L = 73.26'

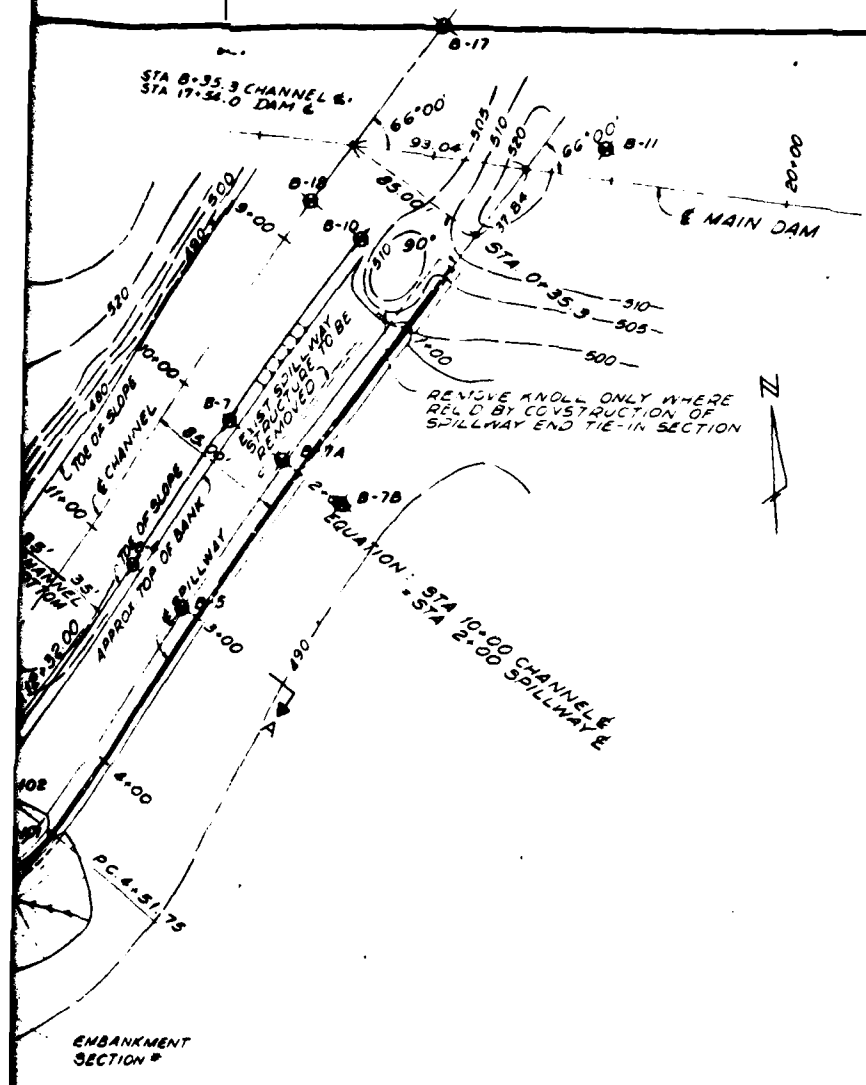
CURVE (3)
Δ = 88°11'10"
R = 78.00'
T = 75.97'
L = 120.05'



SITE PLAN OF SPILLWAY



PROFILE OF SPILLWAY CHANNEL
SCALES 1"=20' VERT. 1"=50' HORIZ.



GENERAL NOTES

A. GENERAL

1. Excavation for 12-inch minimum embedment of spillway base and embankment cutoff trench in sound limestone rock shall be performed such that adjacent rock remains intact and undisturbed.
2. Impervious fill shall be clays and/or silty clays obtained from hillside borrow areas approved by the Engineer.
3. Impervious fill shall be compacted in 8-inch maximum lifts unless otherwise specified to 95 per cent maximum density at optimum moisture content per ASTM Test D-698, "Standard Proctor Method."
4. All fill placed within 2 feet of spillway walls or base sections shall be mechanically compacted in 6-inch maximum lifts to 95 per cent maximum density per ASTM D-698. Backfill shall be uniformly and symmetrically placed.
5. Spillway monoliths and end tie-in sections shall be placed in alternate sections with a minimum elapsed period of 120 hours between placement of adjacent sections.
6. Riprap shall be sound durable quarry-run limestone with a maximum size of 250 lbs.
7. Bedding shall be well-graded sound durable limestone with a maximum size of 3 inches.
8. Surfacing shall be crushed limestone similar to bedding.

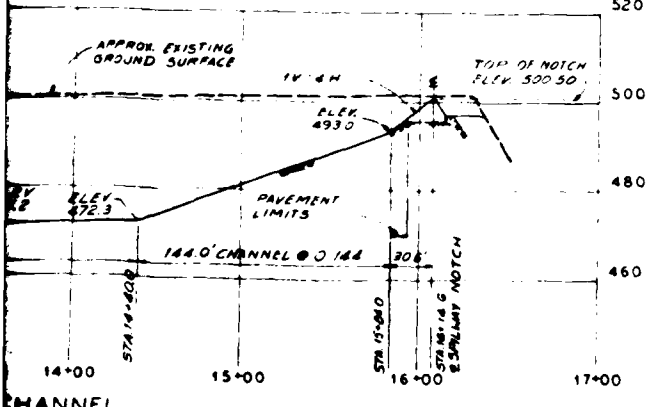
B. CONCRETE

1. All detailing, fabrication, and placing of reinforcing bars shall comply with the ACI "Manual of Standard Practice for Detailing for Reinforced Concrete Structures," ACI-315.
2. All concrete shall have a minimum compressive strength in 28 days of 3,000 psi; shall contain a minimum of 6 sacks of Type II, ASTM C-150 portland cement per cubic yard, and shall not contain more than 5.25 gallons of water (total moisture) per sack of cement. An air-entraining agent, conforming to the requirements of ASTM C-260 shall also be included in the mix. The maximum allowable slump for base sections shall be 2 inches and for walls, 3 inches. Concrete aggregates shall conform to ASTM C-33. Coarse aggregate shall be well graded crushed limestone with a maximum size of 1-1/2 inches. The mix shall be approved by the Engineer prior to construction.
3. All exposed concrete shall be cured with wet burlap coverings for a period of not less than 120 hours. Forms in contact with the concrete shall be kept wet for a period of not less than 120 hours. If forms are removed during the curing period the exposed concrete surface shall be cured, as specified above, for the balance of the curing period. In lieu of moist curing, all concrete may be membrane cured using "Hornecure 40W" (white) curing compound applied at a coverage rate of 200 sq.ft. per gallon.
4. Reinforcing bars, including anchors, shall conform to ASTM A-615, Grade 60.
5. Reinforcing bars shall have a clear concrete cover of 2 inches unless otherwise shown on the drawings.
6. Waterstops shall be 6 inches wide by 3/8 inch thick, 2 bulb type PVC waterstops, manufactured in accordance with CRD-C572.
7. All exposed edges of concrete walls shall have a 3/4-inch chamfer. The upstream and downstream corners of the overflow spillway crest shall be rounded to a 3-inch radius.
8. All exposed unformed concrete surfaces shall have a wood float finish.

NOTES:

1. TEST BORINGS B-4 THRU B-18 DRILLED MAY & JUNE, 1970.
2. TEST BORINGS B-101 THRU B-117 DRILLED JUNE & JULY, 1971

WAY



CHANNEL
ORIZ.

ITEM NOT CONSTRUCTED.

REV. DATE DESCRIPTION

LAKE SAINT LOUIS INVESTMENT CORPORATION

LAKE SAINT LOUIS MAIN DAM

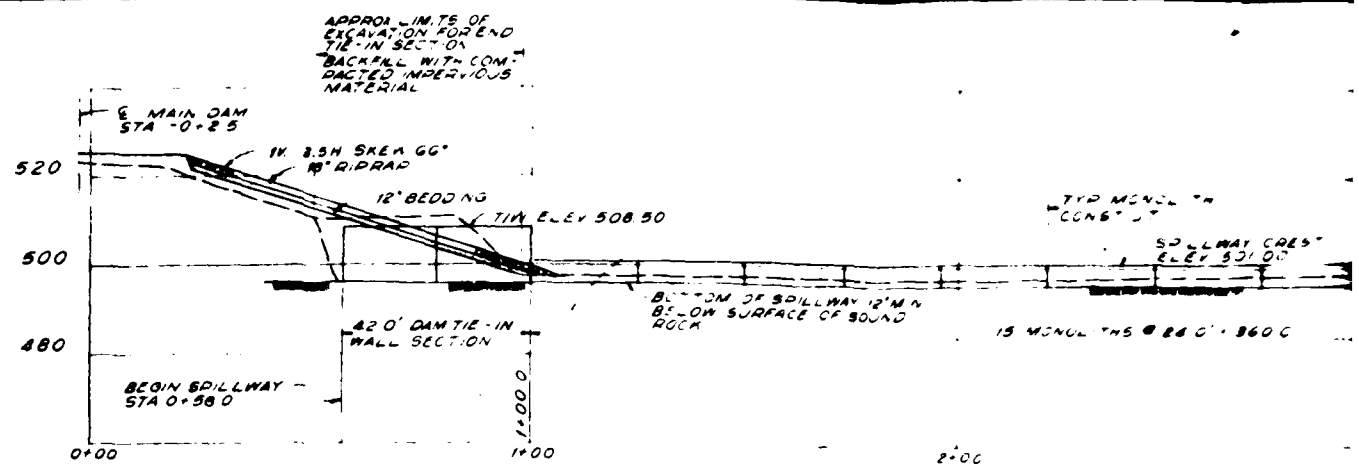
SITE PLAN OF SPILLWAY PROFILE OF CHANNEL

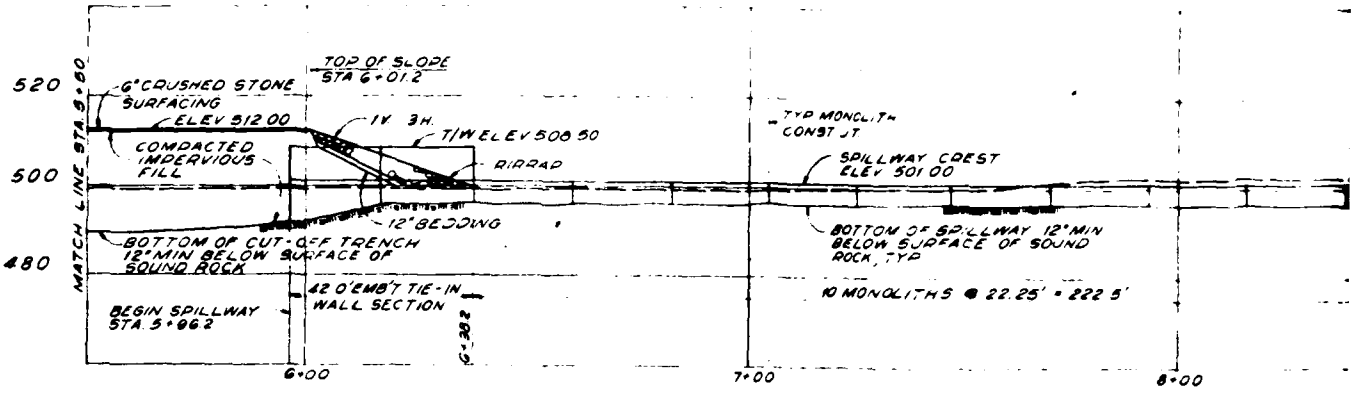
DONALD C. LOCHMOELLER NUMBER E-9240

ALBERT B BECKER, JR NUMBER E 9168

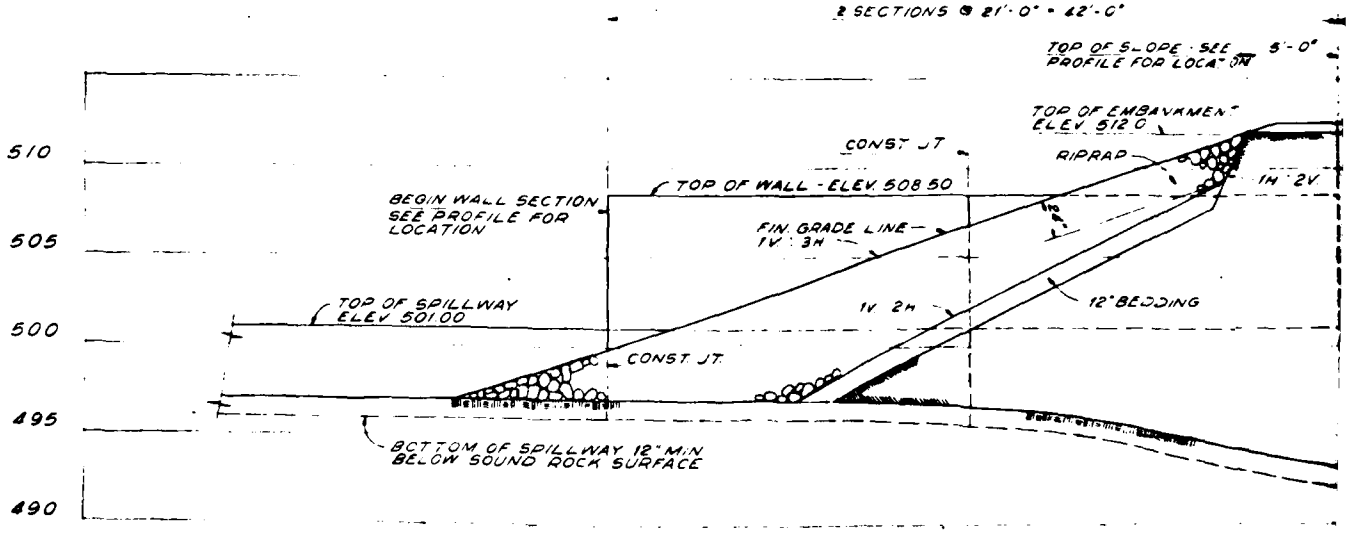
SCALE 1"= 50'	HORNER & SHIFRIN, INC. CONSULTING ENGINEERS ST LOUIS MISSOURI
DESIGNED BY A B B	DATE 2/1/71
DRAWN BY E L M	DRAWING
CHECKED BY D C L	SHEET NUMBER 1
HS NO 7248	

PLA

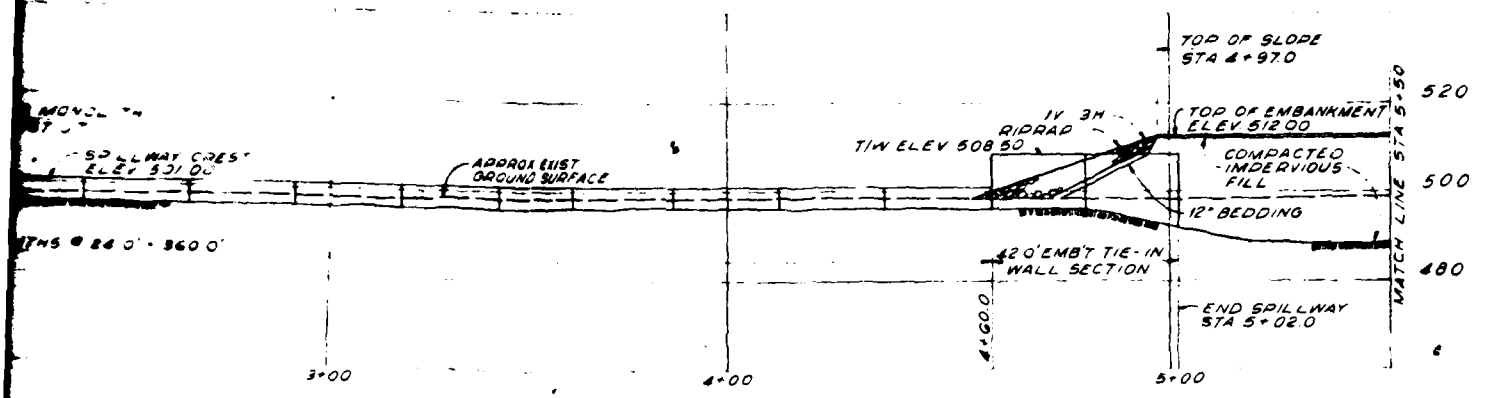


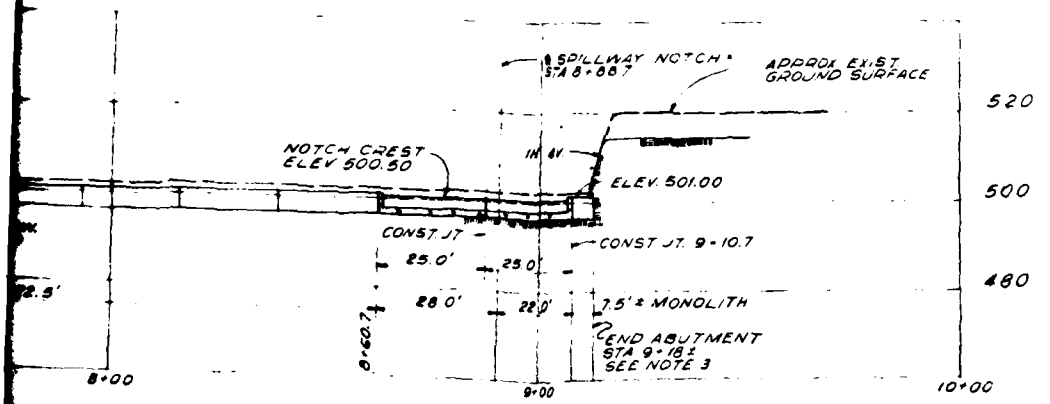


PROFILE OVERFLOW SPILLWAY
Scale: 1" = 20'



ELEVATION TYPICAL SPILLWAY END WALL AT EMB
Scale: 1" = 5'





W SPILLWAY

20'

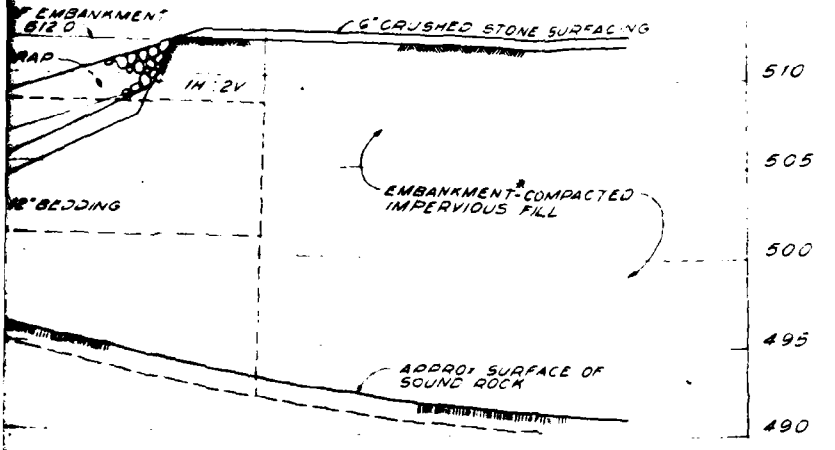
NOTES
1. CONSTRUCT END WALL TIE-IN AT MAIN DAM SIMILAR TO THAT SHOWN FOR END WALL TIE-IN AT EMBANKMENT. PROVIDE CONSTRUCTION JOINT AT MID-POINT OF WALL. LONGITUDINAL REINF. TO EXTEND THRU JOINT.
2. END WALL TIE-IN SECTION AT EMBANKMENT TO FOLLOW ℄ ALIGNMENT OR MAY BE CONSTRUCTED IN CHORDS NOT EXCEEDING 7'-0" IN LENGTH.
3. OVERFLOW SPILLWAY END ABUTMENT TO KEY 1'-0" MIN INTO SOUND ROCK.

-0"

END OF WALL SECTION

OF SLOPE - SEE FILE FOR LOCATION

5'-0"



* ITEM NOT CONSTRUCTED

D WALL AT EMBANKMENT

5'

REV.	DATE	DESCRIPTION	BY

LAKE SAINT LOUIS INVESTMENT CORPORATION

LAKE SAINT LOUIS MAIN DAM

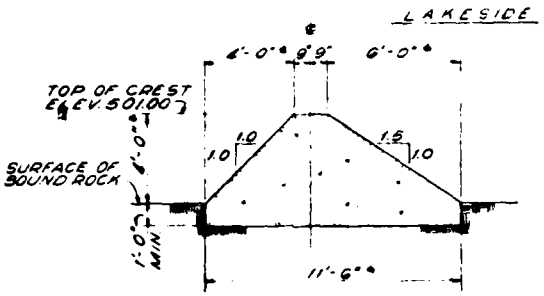
PROFILE OVERFLOW SPILLWAY ELEVATION TYP. SPILLWAY END WALL

SCALE AS SHOWN	HORNER & SHIFRIN, INC. CONSULTING ENGINEERS ST. LOUIS, MISSOURI	DATE JULY 17, 1972
DESIGNED BY: A. B. B.		DRAWING
DRAWN BY: D. E. E.		SHEET NUMBER 2 / TOTAL SHEETS 4
CHECKED BY: D. C. L.		
HS NO. 7248		

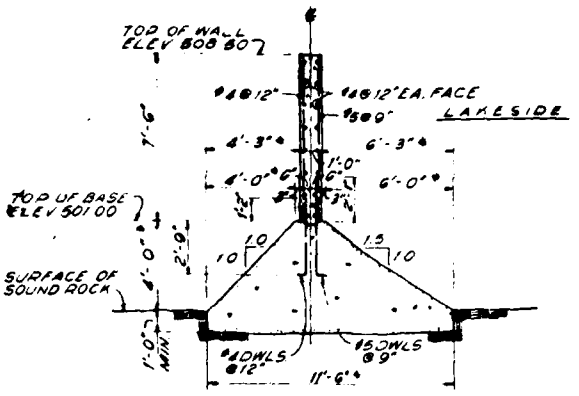
DONALD C. LOCHMOELLER NUMBER E-5960

ALBERT B. BECKER, JR. NUMBER E-9168

PLATE II



TYPICAL OVERFLOW SECTION

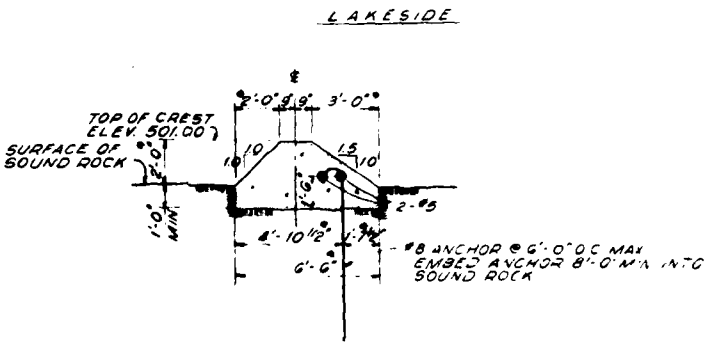


TYPICAL END TIE-IN SECTION

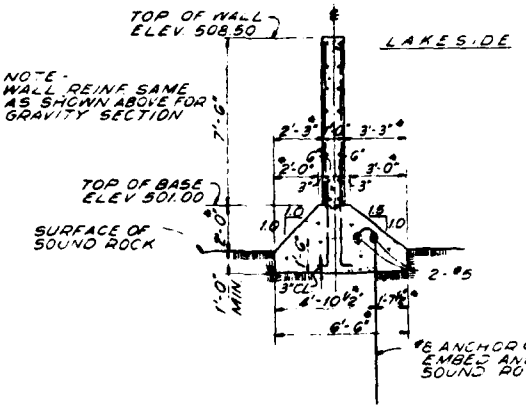
DETAILS OF MINIMUM GRAVITY SPILLWAY SECTIONS

Scale: 1/4" = 1'-0"

SPECIAL NOTE
DIMENSIONS MARKED WITH ASTERISK (*) ARE VARIABLE AND DEPEND ON ELEVATIONS OF SOUND ROCK. HOWEVER THESE DIMENSIONS ARE MINIMUM FOR BOTH THE GRAVITY AND NON-GRAVITY SECTIONS SHOWN



TYPICAL OVERFLOW SECTION

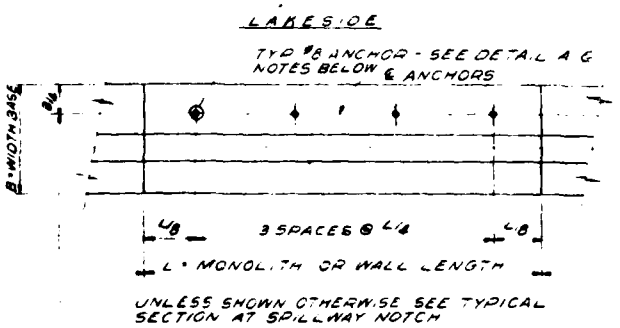


TYPICAL END TIE-IN SECTION

NOTES
1. #5 BARS TO BE CONTINUOUS THRU CONSTRUCTION JOINTS WITH 15" LAP SPLICES, STAGGERED AT ANCHOR LOCATIONS

DETAILS OF MINIMUM NON-GRAVITY SPILLWAY SECT

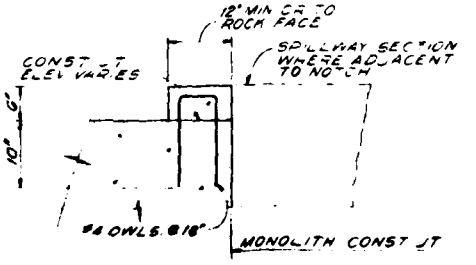
Scale 3/4" = 1'-0"



UNLESS SHOWN OTHERWISE SEE TYPICAL SECTION AT SPILLWAY NOTCH

TYPICAL ANCHOR LOCATION PLAN

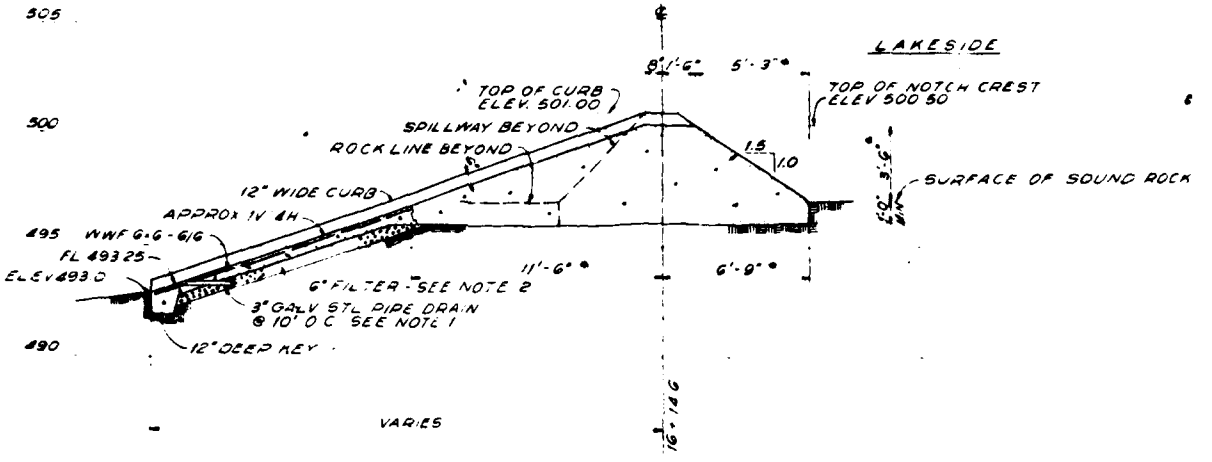
No Scale



TYPICAL DETAIL NOTCH CURB

Scale: 3/4" = 1'-0"

NOTES:
1. GROUT #8 ANCHOR IN 3" ϕ HOLE WITH [illegible] USING A THICK PASTE CONSISTENCY
2. HOLES TO BE DRILLED WITH A ROLLER BIT AND FLUSHED CLEAN OR DRY TO GROUTING

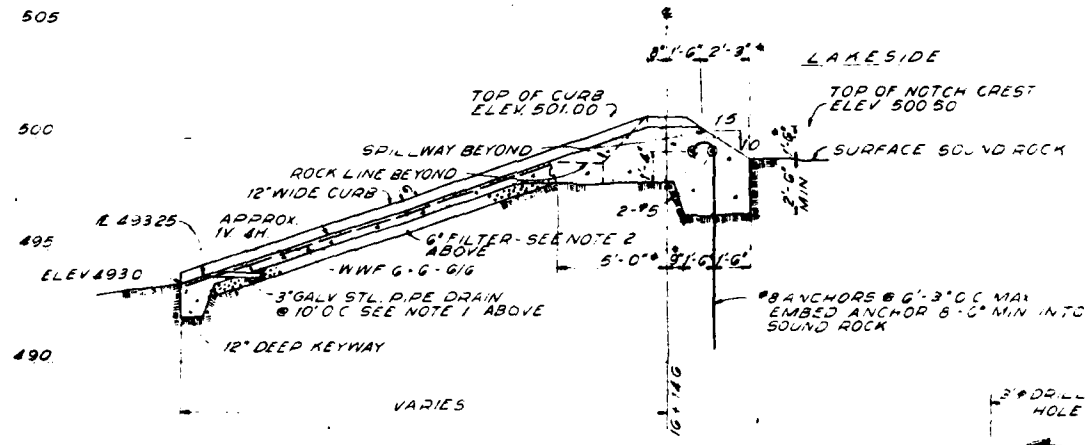


ECTION

PILLWAY SECTIONS

TYPICAL SECTION AT NOTCH

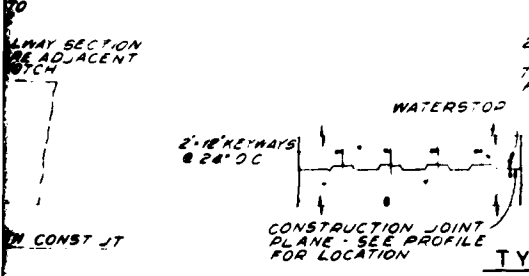
NOTES
1. COVER END OF DRAIN PIPE WITH #4 HARDWARE CLOTH AND SECURE. SLOPE PIPE TO DRAIN.
2. FILTER MATERIAL TO CONSIST OF 3/4" (UNIFORM SIZE) CRUSHED ROCK



ECTION

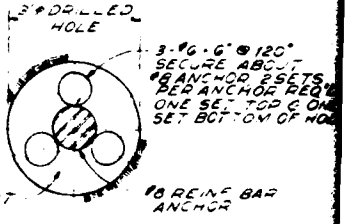
TYPICAL SECTION AT NOTCH

Y SPILLWAY SECTIONS *



TYPICAL CONST. JOINT DETAILS

No Scale



PLAN - ANCHOR HOLE & BAR SETTING

DETAIL A

Scale: Half Size

REV.	DATE	DESCRIPTION

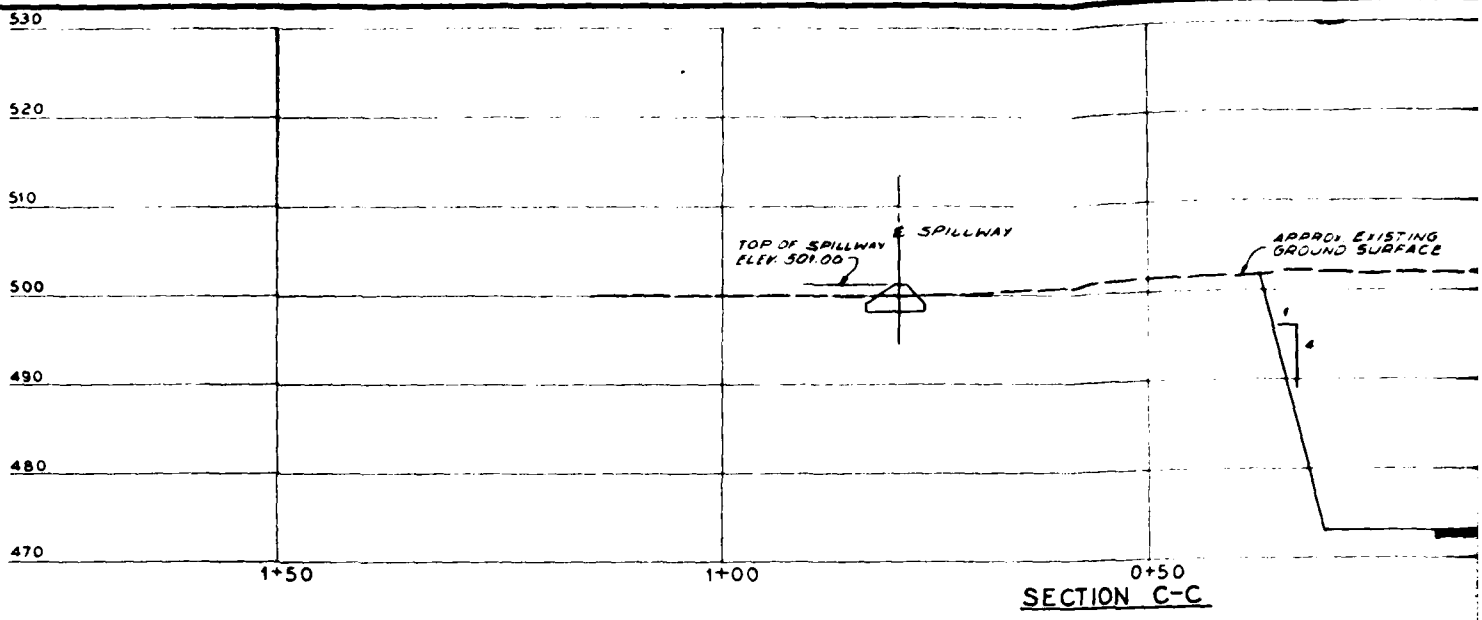
LAKE SAINT LOUIS INVESTMENT CORPORATION

LAKE SAINT LOUIS
MAIN DAM
OVERFLOW SPILLWAY SECTIONS AND DETAILS

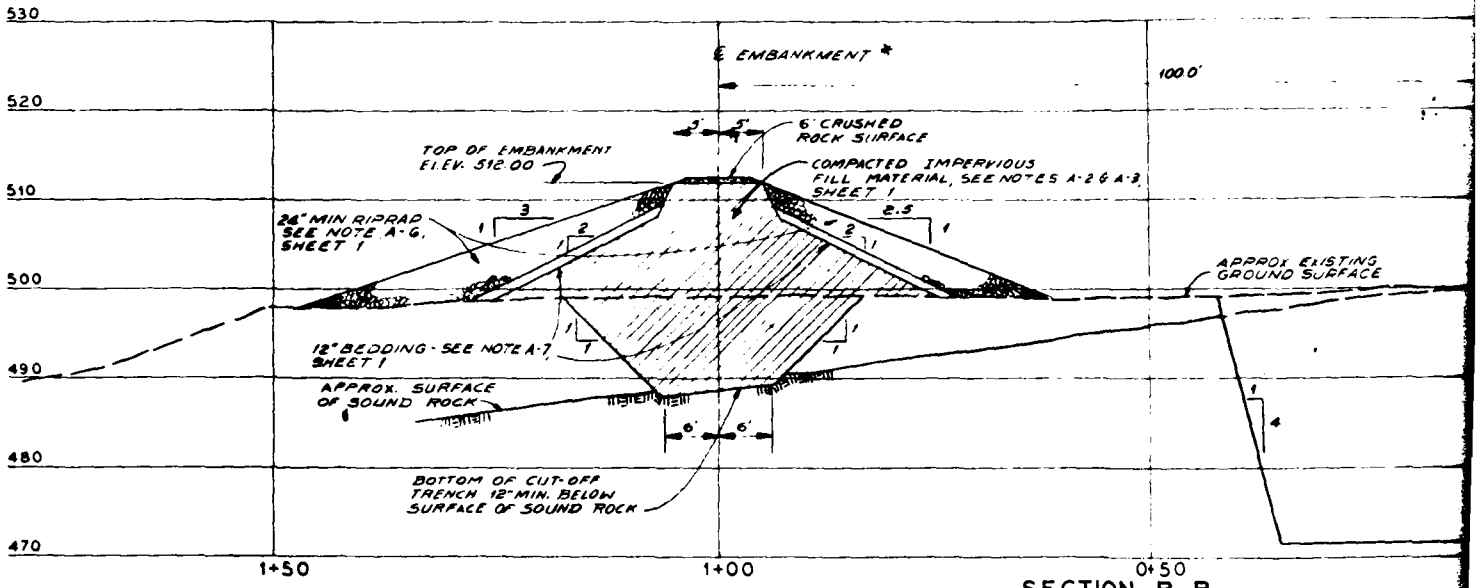
SCALE AS NOTED	HORNER & SHIFRIN, INC. CONSULTING ENGINEERS ST. LOUIS, MISSOURI	DATE JULY 17, 1
DESIGNED BY: A.B.B.		DRAWING
DRAWN BY: D.E.E.		SHEET NUMBER 3
CHECKED BY: J.D.		
HS NO 7248		

DONALD C. LOCHMOELLER NUMBER E-9240 REGISTERED PROFESSIONAL ENGINEER

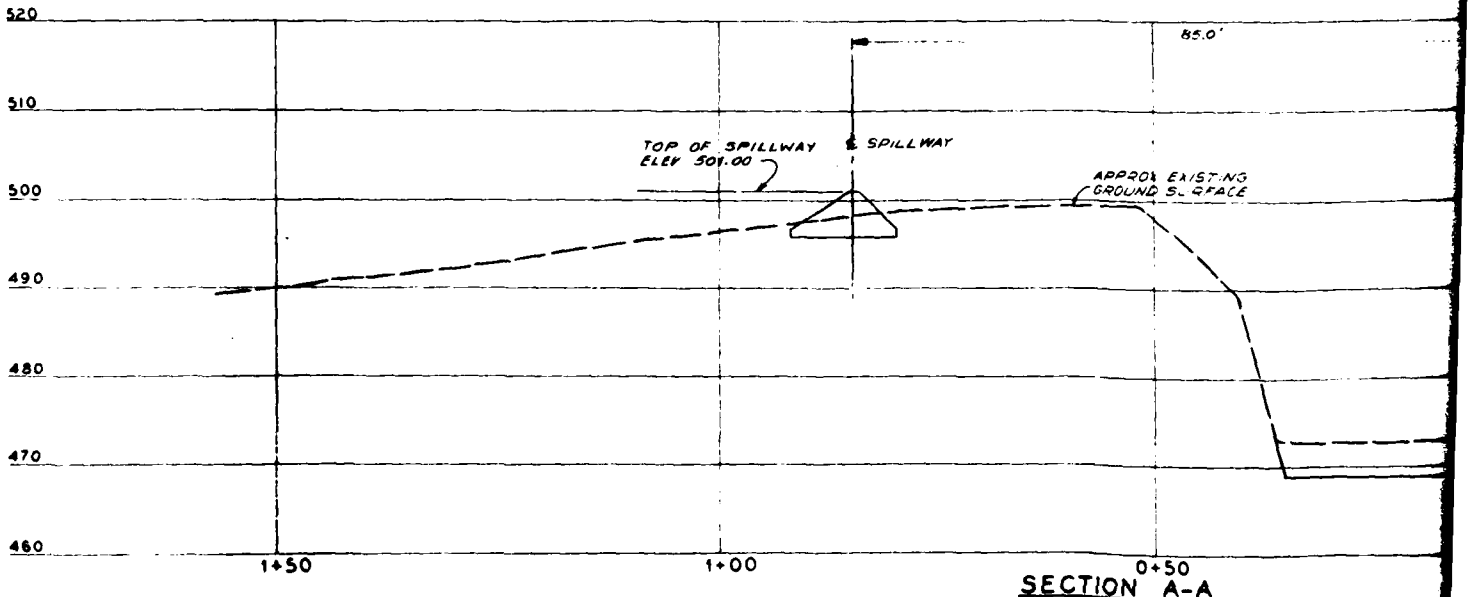
ALBERT B. BECKER, JR. NUMBER E-9168 REGISTERED PROFESSIONAL ENGINEER



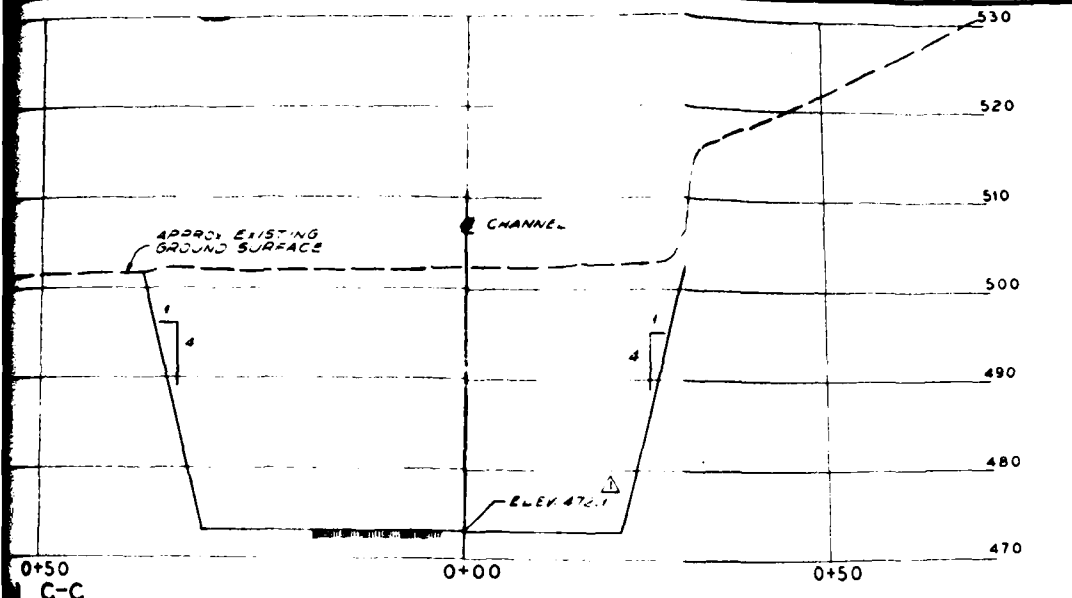
SECTION C-C



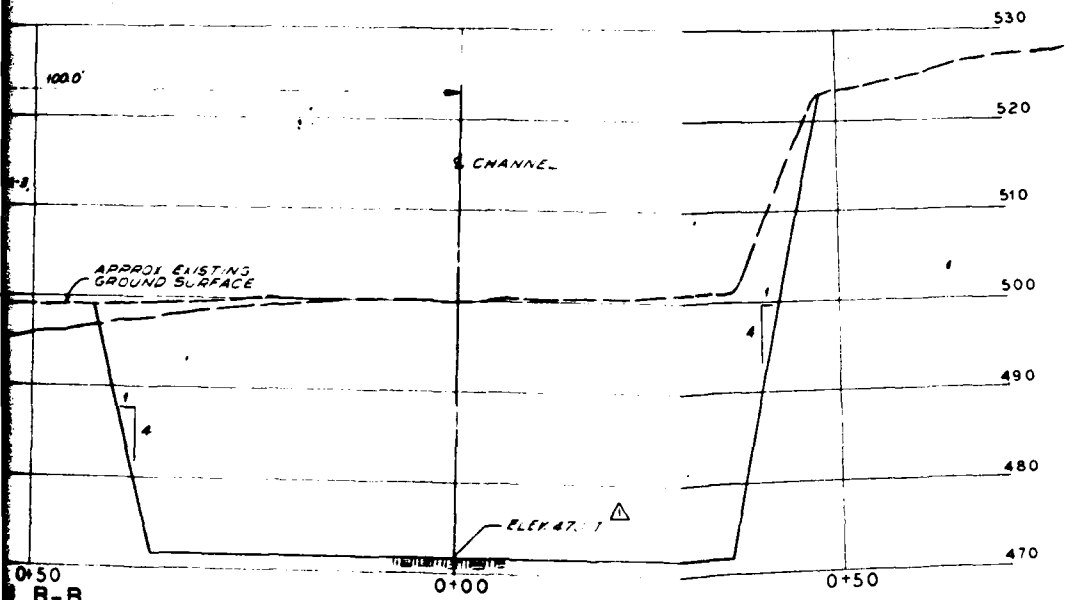
SECTION B-B



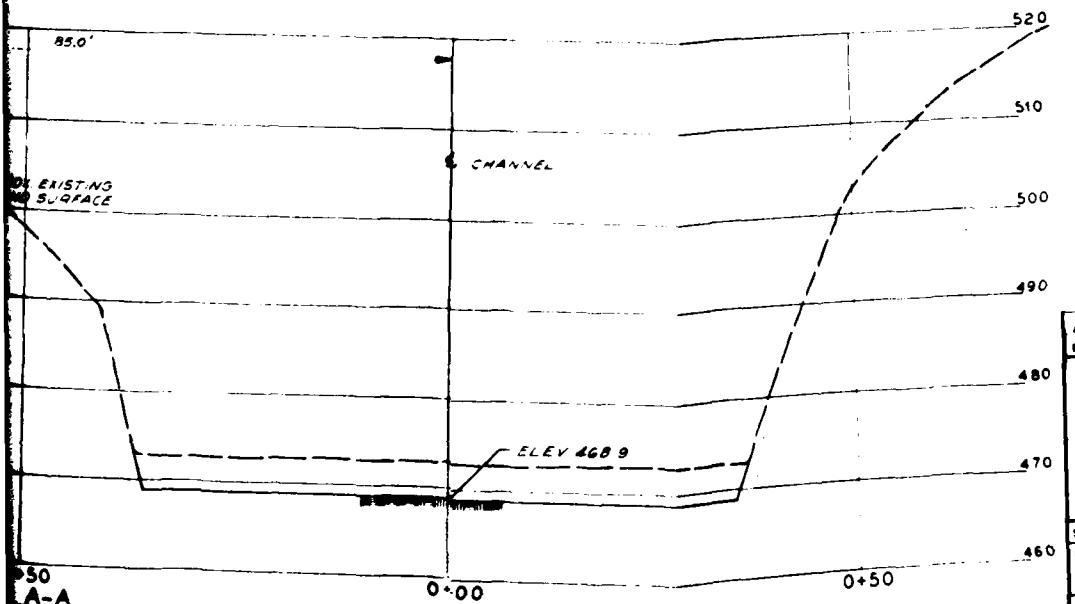
SECTION A-A



C-C



B-B



A-A

* ITEM NOT CONSTRUCTED

DONALD C LOCHMOELLER NUMBER E-9240 REGISTERED PROFESSIONAL ENGINEER

ALBERT B BECKER, JR NUMBER E-9168 REGISTERED PROFESSIONAL ENGINEER

REV	DATE	DESCRIPTION	BY
1		Spillway Channel Flowline Corrected	A.B.B.

LAKE SAINT LOUIS INVESTMENT CORPORATION

LAKE SAINT LOUIS MAIN DAM

SPILLWAY CROSS SECTIONS

SCALE 1"=10

DESIGNED BY A.B.B.
DRAWN BY H.E.W.
CHECKED BY D.C.L.

HS NO 7248

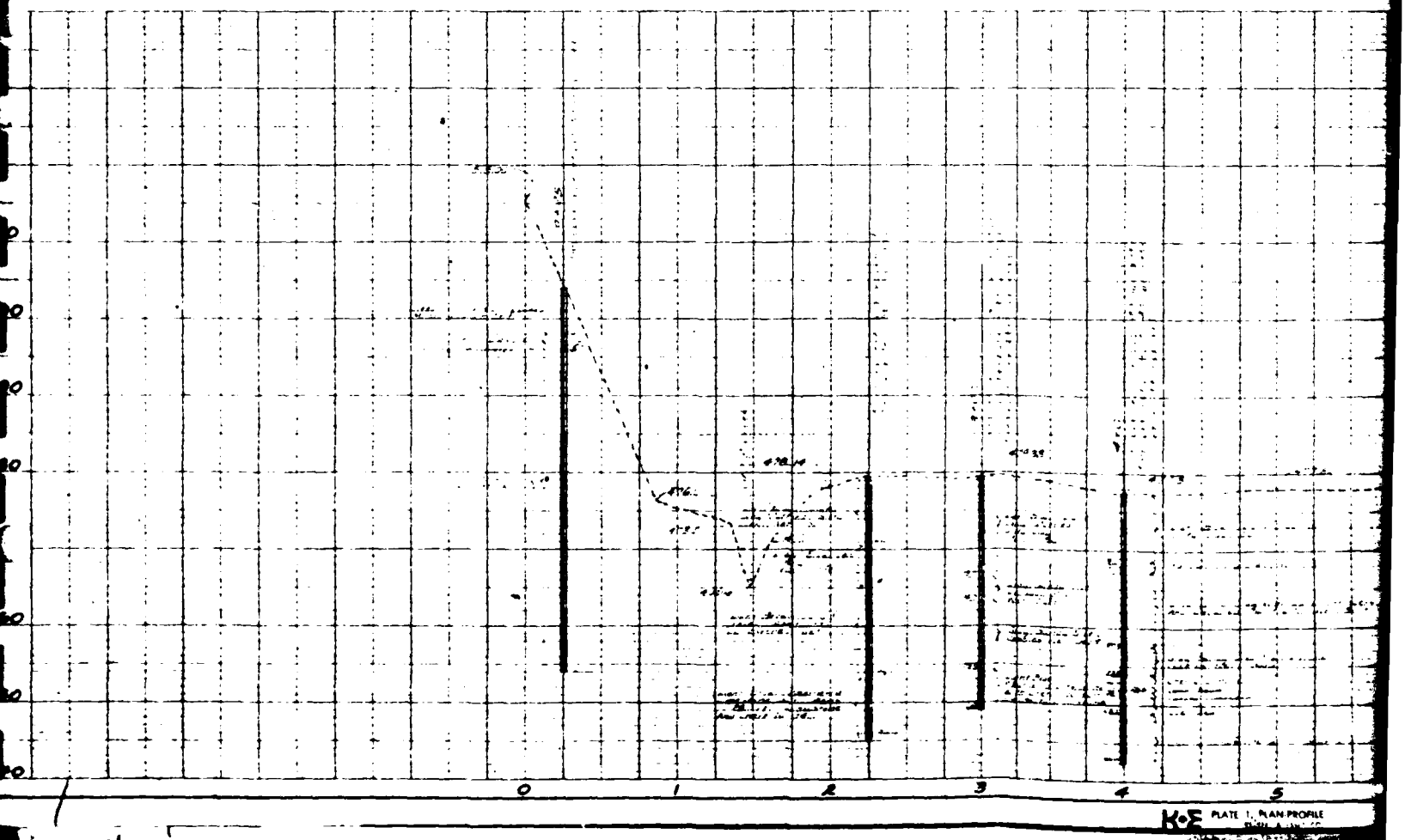
HORNER & SHIFRIN, INC.
CONSULTING ENGINEERS
ST LOUIS MISSOURI

DATE JULY 17 1972

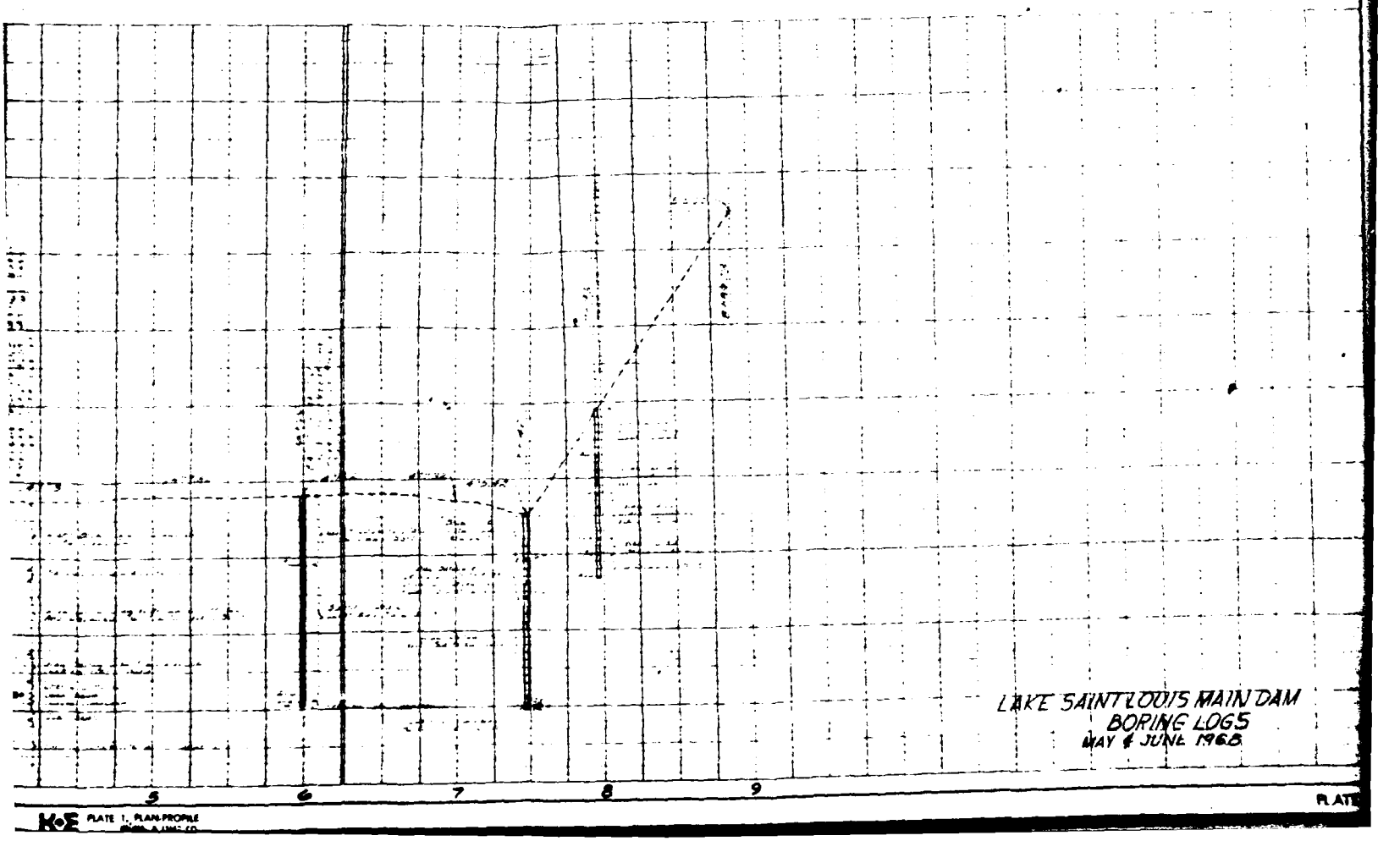
DRAWING

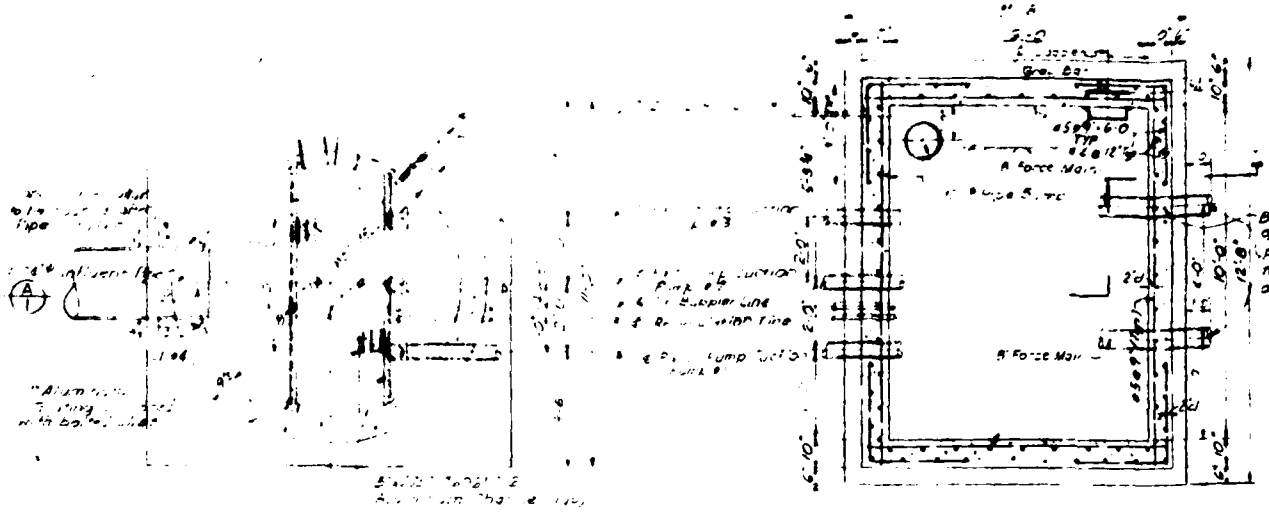
SHEET NUMBER	TOTAL SHEETS
4	4

PLATE 15



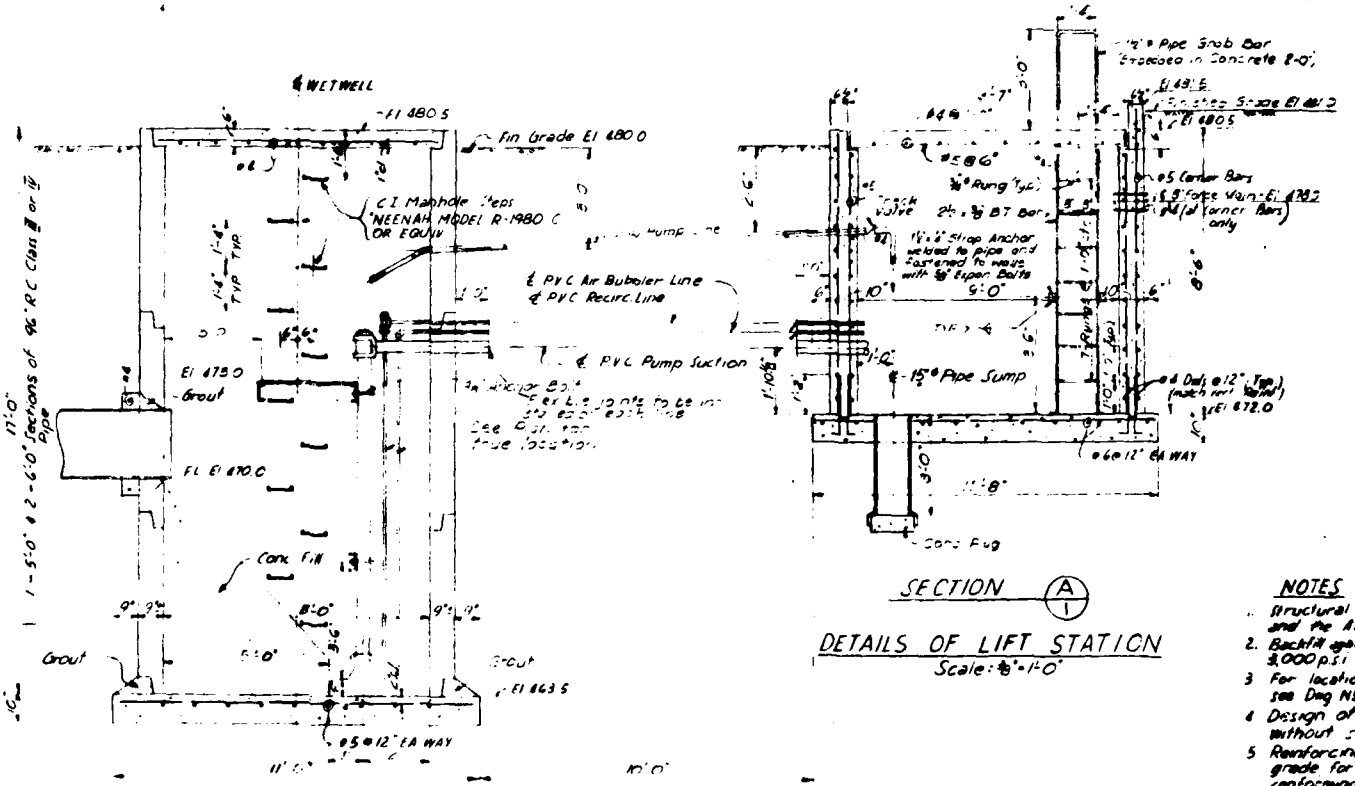
K·E PLATE 1. PLAN PROFILE


LAKE SAINT LOUIS MAIN DAM
BORING LOGS
MAY & JUNE 1968
5
6
7
8
9
PLATE 1. PLAN-PROFILE



PLAN - WETWELL
Scale: 3/8" = 1'-0"

PLAN
Note Slope Base Slab to drain toward sump



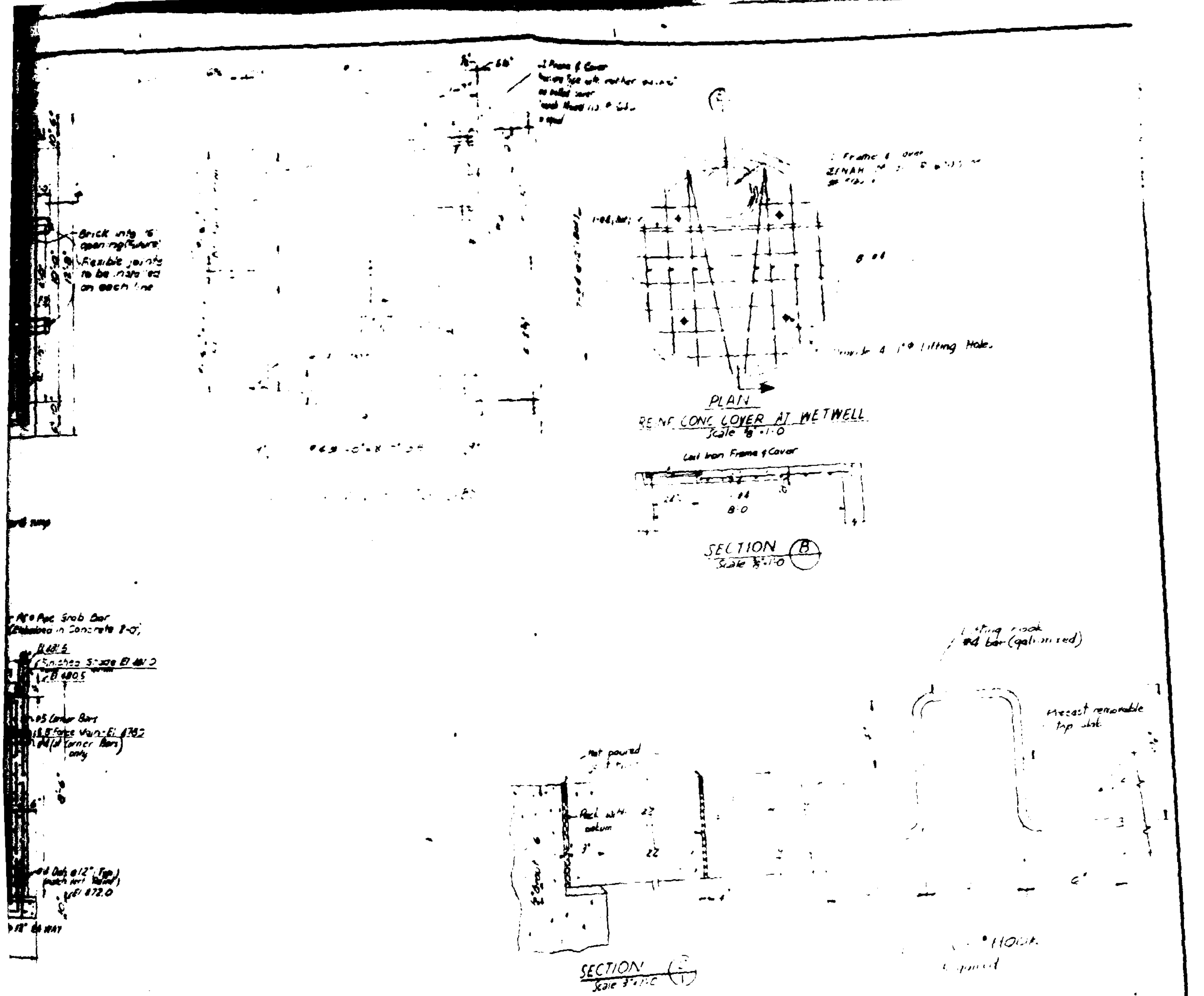
SECTION (A/1)

DETAILS OF LIFT STATION
Scale: 3/8" = 1'-0"

SECTION (A/1)
Scale: 3/8" = 1'-0"

NOTES

1. Structural design ... and the ACI Code
2. Backfill against wall ... 3,000 p.s.i. 28-day
3. For location of ... see Dwg NE 8368-...
4. Design of walls ... without surcharge
5. Reinforcing bars ... grade for new ... conforming to ASTM
6. All exposed edges ...
7. Structural steel ... American Institute ... fabrication and ...
8. Structural steel ...
9. All structural ...
10. All ... Paste ... ers ...
11. Entire ... Lacquer ... after ... coating
12. All holes ... con...
13. Paste ... ers for ... "WEJIT" ... No 3846



NOTES

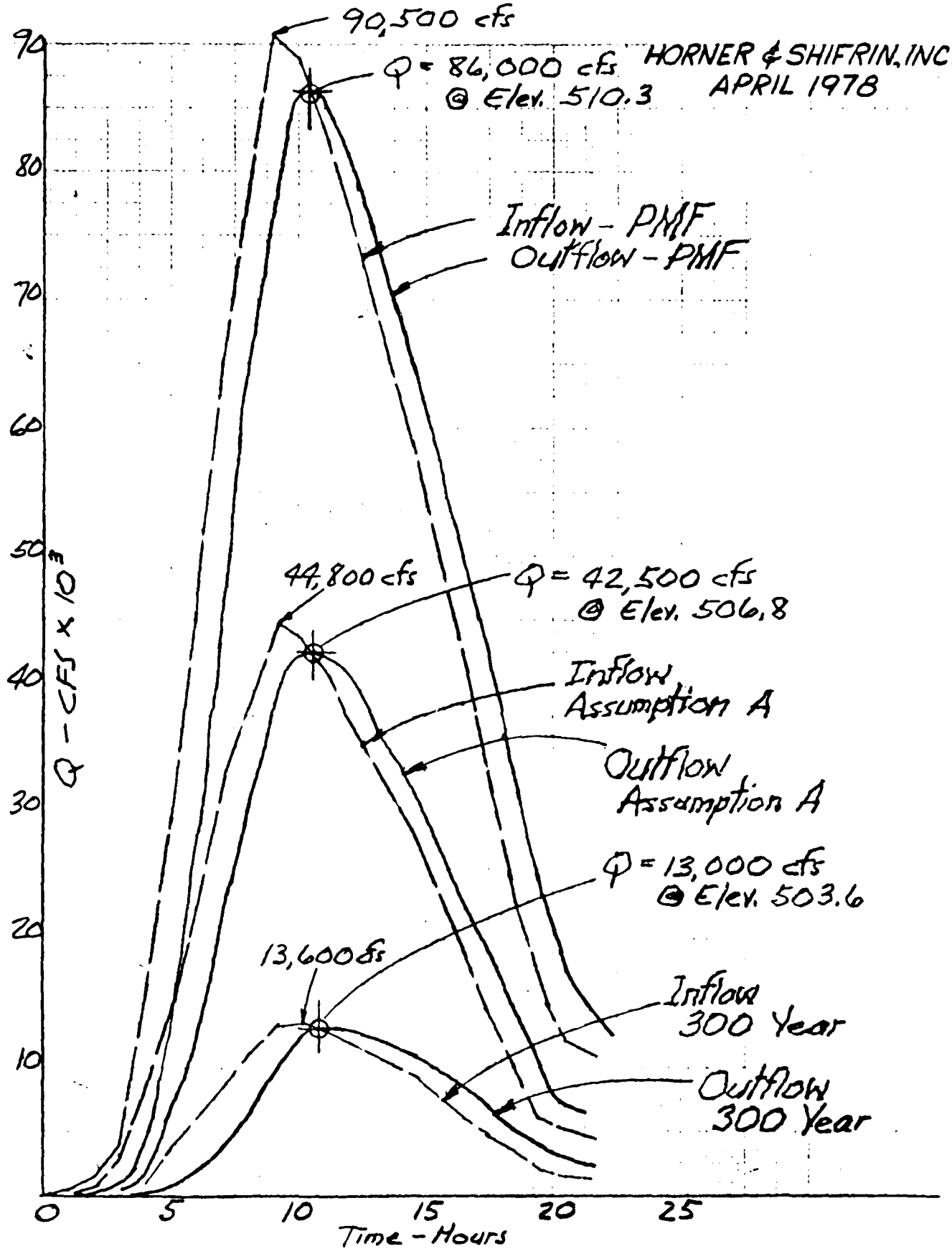
1. Structural design is in accordance with the 1963 AISC Specification and the ACI Code
2. Backfill against walls shall not be placed before concrete has developed 3,000 psi 28-day minimum strength
3. For location of pipes, pumps, anchor bolts and other equipment see Dwg NB 3368-001 Engineered Fluid Process Inc.
4. Design of walls is based on saturated earth pressure of 85 psf without surcharge
5. Reinforcing bars shall conform to ASTM A615 specification [illegible] grade for new billet steel bars Fy = 40,000 psi. All bars shall have deformations conforming to ASTM 305
6. All exposed edges of walls shall have ¾ inch x 45° chamfer
7. Structural steel plates, rolled members and bars shall conform to American Institute of Steel Construction Specification for the design fabrication and erection of structural steel 1963
8. Structural Steel plates & shapes shall conform to ASTM A36
9. All structural steel shall be galvanized (hot dipped after fabrication)
10. All Faste[illegible]
11. Entire Louver [illegible] after fabrication
12. All holes [illegible]
13. Fasteners for Louver shall be Self Sticking [illegible] such as "WEJ-IT" No 5842 or Equal

REV.	DATE	DESCRIPTION	BY

LAKE ST LOUIS INVESTMENT CORPORATION

[illegible] LIFT STATION AND WETWELL

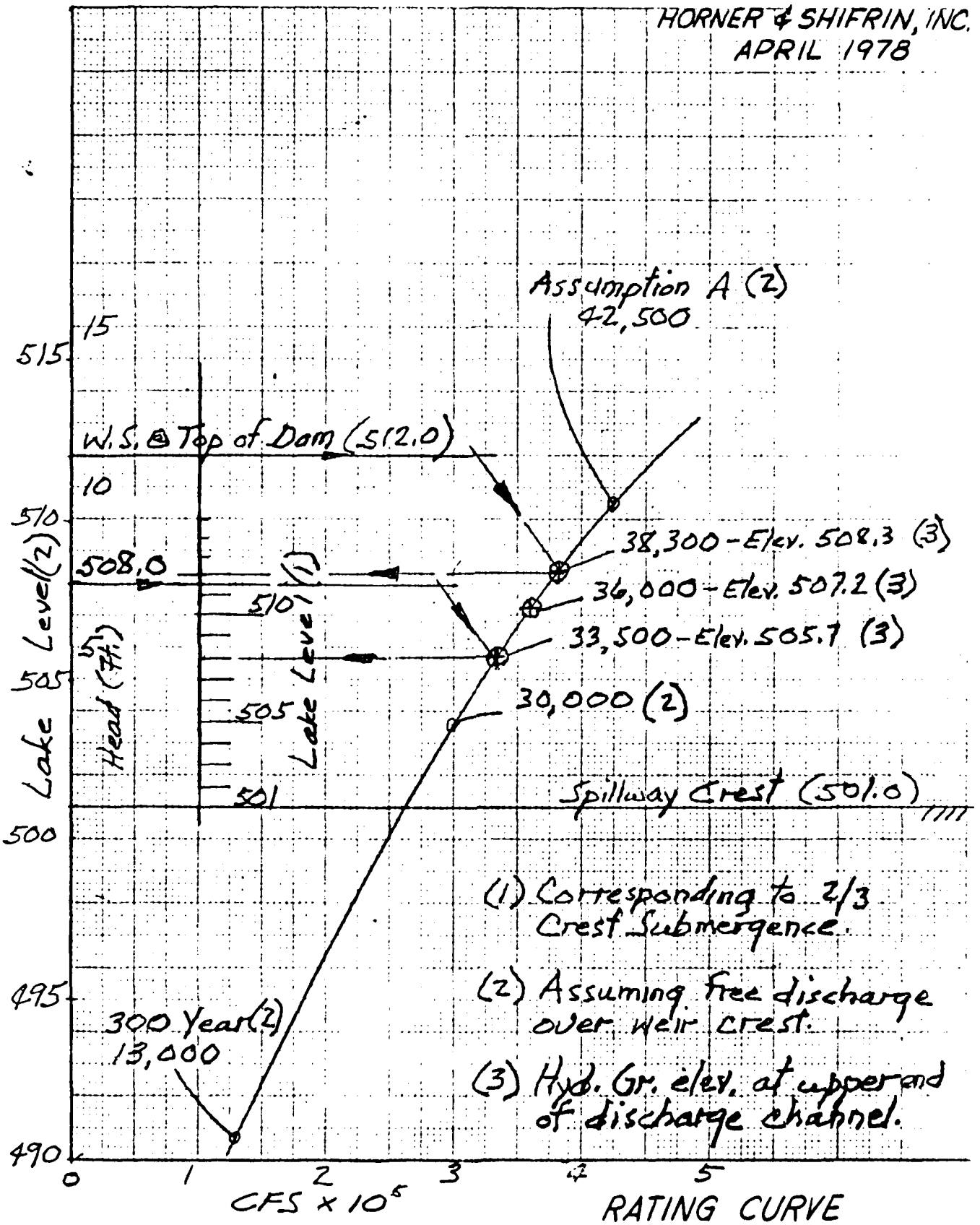
SCALE	HORNER & SHIFRIN, INC. CONSULTING ENGINEERS ST LOUIS, MISSOURI	DATE
DESIGNED BY		DRAWING
DRAWN BY		SHEET NUMBER
CHECKED BY A.F.		TOTAL SHEETS
HS NO		



LAKE INFLOW-OUTFLOW HYDROGRAPHS

PLATE 16

HORNER & SHIFRIN, INC.
APRIL 1978



(1) Corresponding to 2/3 Crest Submergence.

(2) Assuming free discharge over weir crest.

(3) Hyd. Gr. elev. at upper end of discharge channel.

RATING CURVE
SPILLWAY OUTLET CHANNEL

PLATE 17

PROPOSED DAM SITE

SUBSURFACE INVESTIGATION
&
LABORATORY ANALYSIS

FOR

LAKE SAINT LOUIS ESTATES, INC.

R.R. 2, - O'FALLON, MISSOURI

BY

BROWNING TESTING LABORATORIES, INC.

ROUTE 2, HWY. 54 NORTH

FULTON, MISSOURI 65251

(314) 642-5719

CHART 2-1

B & B PRINTING & OFFICE SUPPLY

Route 2, Hwy. 54 North
FULTON, MISSOURI 65251
(314) MI 2-5719

Water Level 3.5' at 0 Hrs.

Job No. 228

Rig No. CME-55

Casing used

Date 5-20-68

Surface Elev.

SS Size Wt of Hammer

Sheet 1 of 9

BORING NO. 1 (7+47) FOR Lake St. Louis

WEATHER Partly Cloudy | TEMP. 65°

ABBREVIATIONS

F.T.-Fish Tail
W.O.-Wash Out
S.T.-Shelby Tube
S.S-Split Spoon
D.B.-Diamond Bit
C. -Core
R.B.-Rock Bit
A. -Auger

Site:
Proposed Dam Site
R.R. 2,
O'Fallon, Missouri

Sample No.	Depth From	Depth To	From Elevation	To Elevation	Distance Feet	Method	Penetration Record: Hydraulic Pressure Psi	Time Interval Sec	Number of Blows	Length Recovered Feet	SAMPLE DESCRIPTION Color – Moisture – Material – Consistency
	0.0	4.0	475.5		4.0	A					Brown, wet, silty clay, very soft.
	4.0	6.0			2.0	ST					" " " " " "
	6.0	9.0			3.0	A					Gray, saturated sandy silt, soft- with sticks of decaying wood and plant life.
	9.0	11.0			2.0	ST					Gray, saturated sandy silt, soft- with sticks of decaying wood & plant life.
	11.0	25.0			14.0	A					Gray sandy silt with scattered gravel.
	25.0	25.5		450.0	0.5	A					Scattered cobbles, bottom on limestone.

CHART P-2

B & B PRINTING & OFFICE SUPPLY

Route 2, Hwy. 54 North
FULTON, MISSOURI 65251
(314) MI 2-5719

Water Level 9.0' at 2 Hrs. Job No. 228

Rig No. CME-59 Casing used Date 5-20-58

Surface Elev. SS Size Wt of Hammer Sheet 2 of 9

BORING NO. 2 (6+00) FOR Lake St. Louis

WEATHER partly cloudy TEMP. 65°

Site: Proposed Dam Site
R.R. 2,
O'Fallon, Missouri

Sample No.	Depth From	Depth To	From Elevation	To Elevation	Distance Feet	Method	Penetration Record: Hydraulic Pressure Psi	Time Interval Sec	Number of Blows	Length Recovered Feet	SAMPLE DESCRIPTION (Color – Moisture – Material – Consistency)
	0.0	4.0	478.1		4.0	A					Lt. brown, moist, silty clay, soft.
	4.0	6.0			2.0	ST					" " " " " "
	6.0	9.0			3.0	A					" " " " " "
	9.0	10.0			1.0	ST					Sand and gravel, cobbles, saturated.
	10.0	27.0			17.0	A					" " " " "
	27.0	27.5		450.6	0.5	A					Refusal on limestone.
											Air test at 10.0', 6, 3, no results as water came up around packer.

ABBREVIATIONS

F.T.-Fish Tail
W.O.-Wash Out
S.T.-Shelby Tube
S.S.-Split Spoon
D.B.-Diamond Bit
C. -Cote
R.B.-Rock Bit
A. -Auger

CHART 2-3

B & B PENTECOST OFFICE SUPPLY

Route 2, Hwy. 54 North
FULTON, MISSOURI 65251
(314) MI 2-5719

Water Level _____ at _____ Hrs.

Job No. 228

Rig No. CME-55

Casing used 25.0'

Date 5-21-68

Surface Elev. _____

SS Size _____ Wt of Hammer _____

Sheet 3 of 9

BORING NO. 3 (4+00) FOR Lake St. Louis

WEATHER clear | TEMP. 60°

ABBREVIATIONS: P.T.-Fish Tail; W.O.-Wash Out; S.T.-Shelby Tube; S.S.-Split Spoon; D.B.-Diamond Bit; C. -Core; R.B.-Rock Bit; A. -Auger

Site: Proposed Dam Site
R.R. 2,
O'Fallon, Missouri

Sample No.	Depth From	Depth To	From Elevation	To Elevation	Distance Feet	Method	Penetration Record: Hydraulic Pressure Psi	Time Interval Sec	Number of Blows	Length Recovered Feet	SAMPLE DESCRIPTION: Color – Moisture – Material – Consistency
	0.0	4.0	477.3		4.0	A					Lt. brown, lt. gray, moist silty clay, soft.
	4.0	6.0			2.0	ST				2.0	" " " " " " " "
	6.0	9.0			3.0	A					" " " " " " " "
	9.0	10.0			1.0	ST				0.6	Sandy silty clay, wet, soft.
	10.0	14.0			4.0	A					Gray silty clay with sand stringers, and decayed plant life, wet, soft.
	14.0	16.0			2.0	ST				2.0	" " " " " "
	16.0	19.0			3.0	A					" " " " " "
	19.0	20.0			1.0	ST				0.6	" " " " " "
	20.0	23.5			3.5	A					Gray sandy clay and limestone cobbles, wet, hard.
	23.5	25.0		452.0	1.5	RB					Cherty limestone

CHART 2-4

B & B PRINTING & OFFICE SUPPLY

Route 2, Hwy. 54 North
FULTON, MISSOURI 65251
(314) MI 2-5719

Water Level _____ at _____ Hrs.

Job No. 228

Rig No _____

Casing used _____

Date _____

Surface Elev. _____

SS Size _____ Wt of Hammer _____

Sheet 4 of 9

BORING NO. 3 cont. FOR

WEATHER	TEMP.

ABBREVIATIONS

F.T.-Fish Tail
W.O.-Wash Out
S.T.-Shelby Tube
S.S.-Split Spoon
D.B.-Diamond Bit
C. -Core
R.B.-Rock Bit
A. -Auger

Sample No.	Depth From	Depth To	From Elevation	To Elevation	Distance Feet	Method	Penetration Record: Hydraulic Pressure Psi	Penetration Record: Time Interval Sec	Penetration Record: Number of Blows	Penetration Record: Length Recovered Feet	Site: / SAMPLE DESCRIPTION Color – Moisture – Material – Consistency
	25.0	25.5			0.5	RB					Open seam.
	25.5	26.0			0.6	RB					Cherty limestone.
	26.0	28.5			2.5	RB					Open seam.
	28.5	35.0		442.0	6.5	RB					Cherty limestone with seams.
											Pressure test at 10.0' - 40 gal. 3 min.
											Pressure test at 30.0' - 45 gal. 3 min.
											(set 25 ft. casing)

CHART 22

B & B PRINTING & OFFICE SUPPLY
FULTON, MISSOURI 65251
(314) MI 2-5719

Water Level ____ at ____ Hrs.
Casing used 25'
SS Size ____ Wt of Hammer ____

Job No. 228
Date 5-21-68
Sheet 5 of 9

Rig No. CME-55
Surface Elev. ____

BORING NO. 4 (3+00) FOR Lake St. Louis

WEATHER clear | TEMP. 70°

Site: Proposed Dam Site
R.R. 2,
O'Fallon, Missouri

Sample No.	Depth From	Depth To	From Elevation	To Elevation	Distance Feet	Method	Penetration Record: Hydraulic Pressure Psi	Time Interval Sec	Number of Blows	Length Recovered Feet	SAMPLE DESCRIPTION: Color – Moisture – Material – Consistency
	0.0	4.0	479.38		4.0	A					Lt. brown-lt. gray mottled, silty clay, moist, soft.
	4.0	6.0			2.0	ST					" " " " " " " "
	6.0	9.0			3.0	A					" " " " " " " "
	9.0	11.0			1.0	ST					" " " " " " " "
	11.0	13.0			1.0	A					" " " " " " " "
	13.0	14.0			1.0	A					Gray, sandy silt, decayed plant, wet, soft.
	14.0	16.0			2.0	ST					" " " " " " " "
	16.0	25.0		454.38	9.0	A					Gray, sandy silt, cobbles, wet, soft.
	25.0	30.0			5.0	RB					Lt. brown, weathered limestone with chert.
											Bottom on cherty limestone.
											Pressure test 10.0' – 45 gal. 2°min.
											Pressure test 28.0' – 30 gal. 2 min.

ABBREVIATIONS
F.T.-Fish Tail
W.O.-Wash Out
S.T.-Shelby Tube
S.S.-Split Spoon
D.B.-Diamond Bit
C. -Core
R.B.-Rock Bit
A. -Auger

CHART 2-6

B & B PRINTING & OFFICE SUPPLY

Route 2, Hwy. 54 North
FULTON, MISSOURI 65251
(314) MI 2-5719

Water Level 11.5 at 12 Hrs.

Job No. 228

Rig No. CME-55

Casing used

Date 5-28-68

Surface Elev.

SS Size Wt of Hammer

Sheet 6 of 9

BORING NO. 5 (2+25) FOR Lake St. Louis

WEATHER	TEMP.	ABBREVIATIONS
		F.T.-Fish Tail W.O.-Wash Out S.T.-Shelby Tube S.S.-Split Spoon D.B.-Diamond Bit C. -Core R.B.-Rock Bit A. -Auger

Site:
Proposed Dam Site
R.R. 2,
O'Fallon, Missouri

Sample No.	Depth From	Depth To	From Elevation	To Elevation	Distance Feet	Method	Penetration Record: Hydraulic Pressure Psi	Time Interval Sec	Number of Blows	Length Recovered Feet	SAMPLE DESCRIPTION: Color – Moisture – Material – Consistency
	0.0	4.0	479.61		4.0	A					Lt. Brown, lt. gray mottled, silty loam,
											wet, soft.
	4.0	6.0			2.0	ST				2.0	" " " " " " "
	6.0	9.0			3.0	A					" " " " " " "
	9.0	11.0			2.0	ST				2.0	Lt. brown, sand and silt, wet, soft.
	11.0	14.0			3.0	A					" " " " " "
	14.0	16.0			2.0	ST				1.0	Lt. brown, sand and gravel, weathered
											limestone, wet.
	16.0	26.0			10.0	A					" " " " " "
	26.0	28.0			2.0	RB					Lt. brown, weathered limestone with seams
											to 28.0 ft. and limestone and chert to 34.0
	28.0	34.0			6.0	RB					" " " " " " "
											Pressure test 12.0' – 45 gal. 3 min.

CHART 2-1

B & B PRINTING & OFFICE SUPPLY

Route 2, Hwy. 54 North
FULTON, MISSOURI 65251
(314) MI 2-5719

Water Level 41' at 0 Hrs.

Job No. 228

Rig No. CME-55

Casing used 19'

Date 6-4-68

Surface Elev. _____

SS Size _____ Wt of Hammer _____

Sheet 7 of 9

BORING NO. 6 (7+95) FOR Lake St. Louis

WEATHER | TEMP.

ABBREVIATIONS
F.T.-Fish Tail
W.O.-Wash Out
S.T.-Shelby Tube
S.S.-Split Spoon
D.B.-Diamond Bit
C. -Core
R.B.-Rock Bit
A. -Auger

Site:
Proposed Dam Site
R.R. 2,
O'Fallon, Missouri

Sample No.	Depth From	Depth To	From Elevation	To Elevation	Distance Feet	Method	Penetration Record: Hydraulic Pressure Psi	Time Interval Sec	Number of Blows	Length Recovered Feet	SAMPLE DESCRIPTION (Color – Moisture – Material – Consistency)
	0.0	6.0			6.0	A					Dark brown, wet silty loam, soft.
	6.0	9.0			3.0	A					Gray sandy silt loam, wet, soft.
	9.0	11.0			2.0	ST					" " " " " "
	11.0	17.0			6.0	A					Gray, sand, gravel, cobbles, wet, medium.
	17.0	19.0			2.0	RB					Weathered cherty limestone.
	19.0	22.0			3.0	RB					Cherty limestone.
											Pressure test at 20' no loss

CHART 2.8

B & D PRINTING & OFFICE SUPPLY
FULTON, MISSOURI 65251
(314) MI 2-5719

Water Level ____ at ____ Hrs.
Casing used 4.0'
SS Size ____ Wt of Hammer ____

Job No. 228
Date 6-6-68
Sheet 8 of 9

Rig No. CME-55
Surface Elev. ____

BORING NO. 7 (8+) FOR Lake St. Louis

WEATHER clear | TEMP. 90°

ABBREVIATIONS
P.T.-Fish Tail
W.O.-Wash Out
S.T.-Shelby Tube
S.S.-Split Spoon
D.B.-Diamond Bit
C. -Core
R.B.-Rock Bit
A. -Auger

Site:
Proposed Dam Site
R.R. 2,
O'Fallon, Missouri

Sample No.	Depth From	Depth To	From Elevation	To Elevation	Distance Feet	Method	Penetration Record: Hydraulic Pressure Psi	Time Interval Sec	Number of Blows	Length Recovered Feet	SAMPLE DESCRIPTION (Color – Moisture – Material – Consistency)
	0.0	2.6			2.6	A					Brown to rusty brown, silty clay, wet, soft
	2.6	50.0			47.4	RB					Cherty limestone,
											No water loss while drilling
											Pressure test at 15' - no loss

CHART 2-9

B & B PRINTING & OFFICE SUPPLY

Route 2, Hwy. 54 North
FULTON, MISSOURI 65251
(314) MI 2-5719

Water Level ____ at ____ Hrs.

Job No. 228

Rig No. CME-55

Casing used 61'

Date 6-11-68

Surface Elev. ____

SS Size ____ Wt of Hammer ____

Sheet 9 of 9

BORING NO. B (0+25) FOR Lake St. Louis

WEATHER Cloudy TEMP. 80°

ABBREVIATIONS
F.T.-Fish Tail
W.O.-Wash Out
S.T.-Shelby Tube
S.S-Split Spoon
D.B.-Diamond Bit
C. -Core
R.B.-Rock Bit
A. -Auger

Site:
Proposed Dam Site
R.R. 2,
O'Fallon, Missouri

Sample No.	Depth From	Depth To	From Elevation	To Elevation	Distance Feet	Method	Penetration Record: Hydraulic Pressure Psi	Time Interval Sec	Number of Blows	Length Recovered Feet	SAMPLE DESCRIPTION (Color – Moisture – Material – Consistency)
	0.0	6.0				RB					Reddish brown, silty clay, moist, medium stiff.
	6.0	7.5				RB					Cherty-limestone.
	7.5	8.0				RB					Clay seam weathered limestone.
	8.0	50.0				RB					Cherty limestone.
											Pressure test at 30' no water loss.

CHART 2-10

B & B PRINTING & OFFICE SUPPLY

Route 2, Hwy. 54 North
FULTON, MISSOURI 65251
(314) MI 2-5719

Water Level _____ at _____ Hrs.

Job No. 228

Rig No. CME-55

Casing used _____

Date 6-12-68

Surface Elev. _____

SS Size _____ Wt of Hammer _____

Sheet 1 of 2

BORING NO. 1,2 and 3 FOR Lake St. Louis

WEATHER clear | TEMP. 80° +

ABBREVIATIONS

F.T.-Fish Tail
W.O.-Wash Out
S.T.-Shelby Tube
S.S.-Split Spoon
D.B.-Diemond Bit
C. -Core
R.B.-Rock Bit
A. -Auger

Site:
Borrow Area West
Proposed Dam Site
R.R.2, - O'Fallon, Missouri

Sample No.	Depth From	Depth To	From Elevation	To Elevation	Distance Feet	Method	Penetration Record: Hydraulic Pressure Psi	Time Interval Sec	Number of Blows	Length Recovered Feet	SAMPLE DESCRIPTION Color – Moisture – Material – Consistency
1	0.0	6.0				A					Lt. brown, silty clay, soft, moist
	6.0	22.0				A					Red, clay, clay with boulders, moist, stiff
2	0.0	6.0				A					Lt. brown, silty clay, soft, moist.
	6.0	22.5				A					Red clay, boulders, moist, stiff.
3	0.0	6.0				A					Lt. brown, silty clay, soft, moist.
	6.0	23.0				A					Red clay, boulders, stiff, moist.

CHART 2-11

B & B PRINTING & OFFICE SUPPLY

Route 2, Hwy. 54 North
FULTON, MISSOURI 65251
(314) HI 2-5719

Water Level _____ at _____ Hrs.

Job No. 228

Rig No. CME-55

Casing used _____

Date 5-12-68

Surface Elev. _____

SS Size _____ Wt of Hammer _____

Sheet 2 of 2

BORING NO. 1, 2, and 3 FOR Lake St. Louis

WEATHER clear | TEMP. 80° +

ABBREVIATIONS

F.T.-Flah Tail
W.O.-Wash Out
S.T.-Shelby Tube
S.S-Split Spoon
D.B.-Diamond Bit
C. -Core
R.B.-Rock Bit
A. -Auger

Site: Borrow Area East
Proposed Dam Site
R.R. 2, - O'Fallon, Missouri

Sample No.	Depth From	Depth To	From Elevation	To Elevation	Distance Feet	Method	Penetration Record: Hydraulic Pressure Psi	Time Interval Sec	Number of Blows	Length Recovered Feet	SAMPLE DESCRIPTION Color – Moisture – Material – Consistency
1	0.0	2.5				A					Lt. brown, silty clay, soft, moist.
	2.5	5.0				A					Reddish brown, silty clay, stiff, moist.
2	0.0	3.0				A					Lt. brown, silty clay, soft, moist.
	3.0	9.0				A					Reddish brown, silty clay, boulders, stiff, moist.
	9.0					A					Bottom on Limestone.
3	0.0	3.0				A					Lt. brown, silty clay, soft, moist.
	3.0	7.5				A					Reddish-brown, silty clay, boulders, stiff, moist.
	7.5					A					Bottom on limestone.

CHART 2-12

BROWNING TESTING LABORATORIES, INC.
Route 2, Hwy. 54 North
Fulton, Missouri 65251
(314) 642-5719

DATA SUMMARY SHEET

LABORATORY TESTS

JOB NO. 228

DATE 6-18-68

ATTERBERG LIMITS:			
HOLE NO.			
DEPTH FT.	6 - 28	0 - 6	
LIQUID LIMIT	50%	28%	
PLASTIC LIMIT	22%	20%	
PLASTIC INDEX	28	8	
SHRINKAGE LIMIT	8	18	
NATURAL MOISTURE	37%	18%	
AASHO SOIL CLASSIFICATION	A-7-6	A-6	
FAA SOIL CLASSIFICATION	E-8	E-7	
UNIFIED SOIL CLASSIFICATION	CH	CL	

REMARKS:

Borrow Area West
Lake St. Louis

CHART 2-13

TEST DRILLING SERVICE Company

Soil Sampling
Core Drilling
Site Explorations
Pressure Grouting
Geological Investigations

5121 NO. LINDBERGH BLVD. • BRIDGETON, MO. 63042 • 314-731-1111

23 July 1969

Horner & Shifrin, Inc.
Consulting Engineers
1221 Locust Street
St. Louis, Missouri 63103

Attention: Mr. Don Lochmoeller

RE: Test Drilling Report
and Pressure Test Data
For Lake St. Louis
Project, St. Charles
County, Missouri

Dear Don:

Per your instructions we have completed the test drilling along the center line of the proposed dam and spillway section. Results of this investigation are enclosed for your review. Testing procedure was performed under your instruction letter of July 3, 1969. It was quite apparent throughout the duration of the water pressure tests that the bedrock appears quite sound and continuous. In addition to your instructions we initiated the use of a water meter to verify that the formation was not taking water, during the constant pressure test. It should be noted that before the test section time that all pressures were held for a period of ten minutes before the initial readings were taken. In all cases the pressure readings held constant or increased slightly, within the accuracy of the pressure test gauge.

For your information our diamond setting for NXM series coring is 2 7/8" O.D.. The cores taken on this project will be held in our warehouse until notice is given to deliver to your preference.

Per your request we are at this time working-up a bid on a per cubic yard basis, with an estimated 35,000 cubic yards of limestone excavation. We are bidding on the basis of drilling and shooting with the removal of the material shot, by others.

Thank you for calling on Test Drilling Service Company for [illegible] work. If you have any questions concerning the enclosed [illegible] data, please contact us at your convenience. With best [illegible]

Very truly yours,

TEST DRILLING SERVICE COMPANY

Donald L. Ramsey

Donald L. Ramsey, Geologist

CHART 2-14

DRILLING SERVICE COMPANY

PHONE: 314-731-1111 5121 NO. LINDBERGH BLVD. BRIDGETON, MO. 63042 ST. LOUIS COUNTY

FIELD BORING LOG

Project LAKE ST. LOUIS Job No. 247

Boring 2 Location PER CLIENT INSTRUCTIO Surface El ~~510~~ : 514.6

Drilling Co. TEST DRILLING SERVICE CO. Boring Type NXM CORE

Date 7-14-69 Rig 63 Inspector TED LEAR

	CORE RUN From	CORE RUN To	Total Run	Core Recovery	Percent Recovery	CLASSIFICATION	PRESSURE TEST Pac. Loc. (Ft) / Bot Hole (Ft)	Pressure (Psi)	Inflow (Gpm)
						0.0 - 7.0' Red Residual Stiff Clay W/Heavy Gravel & Boulders			
507.6	7.0	10.0	3.0	1.9	63.3	7.0 - 9.0' Medium Gray, Hard Dense, Medium Bedded Fine to Medium Crystaline			
504.6	10.0	15.0	5.0	4.0	80.0	Limestone W/Chert Nodules			
						9.0' - 11.0'			
499.6	15.0	20.0	5.0	5.0	100	Red Gravelly Clay			
						11.0-18.8'			
494.6	20.0	25.0	5.0	5.0	100	Medium Gray Hard Dense Medium Bedded, Medium Crystaline Limestone			
489.6	25.0	30.0	5.0	5.0	100	with Numerous Chert Band & Nodules Up to 8" in Dimesnion			
						18.8-24.0'			
479.6	35.0	40.0	5.0	5.0	100	Lt Gray, Medium to Massive Bedded, Coarsely Crystaline, Hard,			
474.6	40.0	45.0	5.0	5.0	100	Fossiliferous Limestone W/Styolitic Partings			
469.6	45.0	50.0	5.0	5.0	100	24.0-35.5' Light Gray, Thin To Medium Bedded, Coarsely, Crystaline, Hard, Fossiliferous Limestone W/Numerous Chert Bands & Nodules up to 10" Dimension			
						35.5-39.0' Lt Gray, Medium to Massive Bedded, Coarsely Crystaline, Hard, Fossiliferous Limestone W/Styolitic Partings			
						39.0-50.0' Light Gray, Thin to Medium Bedded, Coarsely Crystaline, Hard, Fossiliferous Limestone W/Numerous Chert bands & Nodules Up to 6" Dimension & Numerous Buff Weathered Portions			
						50.0' Bottom of Test Hole Per Client Instruction			

Drilling Fluid CLEAR WATER Casing 12.0' Press. Gage Loc. @ Gr. Surf.

Ground Water Depth 27.0' Date 7-17-69 Method Det. STEEL TAPE

Remarks SEE ATTACHED PRESSURE TEST SHEETS NO. 2 THRU 6

CHART 2 '5

TEST DRILLING SERVICE COMPANY

SHEET 2 OF 6

DATE 7-17-69

REPORT OF WATER PRESSURE TESTING IN CORE DRILL HOLES

DAM SITE LAKE ST. LOUIS RIVER PERIOUE CK HOLE NO. 2 LOG NO. 43

LOCATION OF HOLE PER CLIENT INSTRUCTION

CONTRACTOR TEST DRILLING SERVICE CO. DRILLER E. STEVENS ELEV TOP OF HOLE 510±

DATA ON FLOW TEST

SECTION OF HOLE TESTED				PRESSURE DURING TEST	TIME STARTED	TIME STOPPED	TIME MINUTES	WATER METER READINGS			
TOP		BOTTOM						AT START OF TEST	AT END OF TEST	TOTAL GAL OF WATER USED	GAL PER MINUTE
DEPTH	ELEV	DEPTH	ELEV								

REMARKS

ELEV TOP ROCK –

BOTTOM HOLE –

¥ UNABLE TO OBTAIN ANY GAGE PRESSURE AT START OF TEST

DATA ON PRESSURE DURATION TEST

SECTION OF HOLE TESTED				GAUGE PRESSURE AT TEST INTERVALS (PSI)					REMARKS
TOP		BOTTOM		AT START OF TEST	15 SECS	30 SECS	AT [illegible]	60 SECS	
DEPTH	ELEV	DEPTH	ELEV						
45.0	465	50.0'	460	45	46	47	46	46	
45.0	465	50.0'	460					46	
45.0	465	50.0'	460					46	
45.0	465	50.0'	460					46	
45.0	465	50.0'	460					46	

OBSERVED BY D. L. Ramsey

CHART 2-16

TEST DRILLING SERVICE COMPANY

SHEET 3 OF 6

DATE 7-17-69

REPORT OF WATER PRESSURE TESTING IN CORE DRILL HOLES

DAM SITE LAKE ST. LOUIS RIVER PERUQUE CK [illegible] 2 HOLE NO. 43

LOCATION OF HOLE PER CLIENT INSTRUCTION

CONTRACTOR TEST DRILLING SERVICE CO. DRILLER C. STEVENS ELEV. TOP OF HOLE 510 ±

DATA ON FLOW TEST

SECTION OF HOLE TESTED				PRESSURE DURING TEST	TIME STARTED	TIME STOPPED	TIME MINUTES	WATER METER READINGS			
TOP		BOTTOM						AT START OF TEST	AT END OF TEST	TOTAL GAL OF WATER USED	GAL PER MINUTE
DEPTH	ELEV	DEPTH	ELEV								

REMARKS:

ELEV TOP ROCK—

BOTTOM HOLE—

* UNABLE TO OBTAIN ANY GAGE PRESSURE AT START OF TEST

DATA ON PRESSURE DURATION TEST

SECTION OF HOLE TESTED				GAUGE PRESSURE AT TEST INTERVALS (PSI)					REMARKS
TOP		BOTTOM		AT START OF TEST	15 SECS	30 SECS	45 SECS	60 SECS	
DEPTH	ELEV	DEPTH	ELEV						
40.0	470	45.0	465	40	40	40	40	40	
40.0	470	45.0	465					40+	
40.0	470	45.0	465					41	
40.0	470	45.0	465					41	
40.0	470	45.0	465					41	

OBSERVED BY D. L. RAMSEY

CHART 2-17

TEST DRILLING SERVICE COMPANY

SHEET 4 OF 6
DATE 7-17-69

REPORT OF WATER PRESSURE TESTING IN CORE DRILL HOLES

DAM SITE LAKE ST. LOUIS RIVER PERIQUE CK UNIT NO. 2 DRG. NO. 43
LOCATION OF HOLE PER CLIENT INSTRUCTION
CONTRACTOR TEST DRILLING SERVICE CO. DRILLER C. STEVENS ELEV. TOP OF HOLE 510±

DATA ON FLOW TEST

SECTION OF HOLE TESTED				PRESSURE DURING TEST	TIME STARTED	TIME STOPPED	TIME MINUTES	WATER METER READINGS			
TOP		BOTTOM						AT START OF TEST	AT END OF TEST	TOTAL GAL OF WATER USED	GAL PER MINUTE
DEPTH	ELEV	DEPTH	ELEV								

REMARKS:
ELEV TOP ROCK—
BOTTOM HOLE—

* UNABLE TO OBTAIN ANY GAGE PRESSURE AT START OF TEST

DATA ON PRESSURE DURATION TEST

SECTION OF HOLE TESTED				GAUGE PRESSURE AT TEST INTERVALS (PSI)					REMARKS
TOP		BOTTOM		AT START OF TEST	15 SECS	30 SECS	45 SECS	60 SECS	
DEPTH	ELEV	DEPTH	ELEV						
35.0	475	40.0	470	35	35	35	35	35	
35.0	475	40.0	470					35	
35.0	475	40.0	470					35	
35.0	475	40.0	470					35	
35.0	475	40.0	470					35	

OBSERVED BY D. L. RAMSEY

CHART 2-18

TEST DRILLING SERVICE COMPANY

SHEET 5 OF 6
DATE 7-17-69

REPORT OF WATER PRESSURE TESTING IN CORE DRILL HOLES

DAM SITE LAKE ST. LOUIS RIVER PERIQUE CK HOLE NO. 2 RIG NO. 43
LOCATION OF HOLE PER CLIENT INSTRUCTION
CONTRACTOR TEST DRILLING SERVICE CO. DRILLER C. STEVENS ELEV. TOP OF HOLE 510±

DATA ON FLOW TEST

SECTION OF HOLE TESTED				PRESSURE DURING TEST	TIME STARTED	TIME STOPPED	TIME MINUTES	WATER METER READINGS			
TOP		BOTTOM						AT START OF TEST	AT END OF TEST	TOTAL GAL OF WATER USED	GAL PER MINUTE
DEPTH	ELEV	DEPTH	ELEV								

REMARKS:
ELEV TOP ROCK–
BOTTOM HOLE–

* UNABLE TO OBTAIN ANY GAGE PRESSURE AT START OF TEST

DATA ON PRESSURE DURATION TEST

SECTION OF HOLE TESTED				GAUGE PRESSURE AT TEST INTERVALS (PSI)					REMARKS
TOP		BOTTOM		AT START OF TEST	15 SECS	30 SECS	45 SECS	60 SECS	
DEPTH	ELEV	DEPTH	ELEV.						
30.0	480	35.0	475	30	30	30	30	30+	
30.0	480	35.0	475					30+	
30.0	480	35.0	475					31-	
30.0	480	35.0	475					31	
30.0	480	35.0	475					31	

OBSERVED BY D. L. RAMSEY

CHART 2-19

TEST DRILLING SERVICE COMPANY

SHEET 6 OF 6
DATE 7-17-69

REPORT OF WATER PRESSURE TESTING IN CORE DRILL HOLES

DAM SITE LAKE ST. LOUIS RIVER PERIQUE CK HOLE NO. 2 B & O NO 43
LOCATION OF HOLE PER CLIENT INSTRUCTION
CONTRACTOR TEST DRILLING SERVICE CO. DRILLER C. STEVENS ELEV TOP OF HOLE 510±

DATA ON FLOW TEST

SECTION OF HOLE TESTED				PRESSURE DURING TEST	TIME STARTED	TIME STOPPED	TIME MINUTES	WATER METER READINGS			
TOP		BOTTOM						AT START OF TEST	AT END OF TEST	TOTAL GAL OF WATER USED	GAL PER MINUTE
DEPTH	ELEV	DEPTH	ELEV								

REMARKS:
ELEV TOP ROCK –
BOTTOM HOLE –

* UNABLE TO OBTAIN ANY GAGE PRESSURE AT START OF TEST

DATA ON PRESSURE DURATION TEST

SECTION OF HOLE TESTED				GAUGE PRESSURE AT TEST INTERVALS (PSI)					REMARKS
TOP		BOTTOM		AT START OF TEST	15 SECS	30 SECS	45 SECS	60 SECS	
DEPTH	ELEV	DEPTH	ELEV						
25.0	485	30.0	480	25	25	25+	25+	25+	
25.0	485	30.0	480					25+	
25.0	485	30.0	480					25+	
25.0	435	30.0	480					26–	
25.0	485	30.0	480					26–	

OBSERVED BY D. L. RAMSEY

CHART 2-20

DRILLING SERVICE COMPANY

PHONE: 314-731-1111 5121 NO. LINDBERGH BLVD. BRIDGETON, MO. 63042 ST. LOUIS COUNT

FIELD BORING LOG

Project LAKE ST. LOUIS Job No. 247

Boring 3 Location PER CLIENT INSTRUCTIO Surface El 476.7

Drilling Co. TEST DRILLING SERVICE CO. Boring Type NXM CORE

Date 7-8-69 Rig 63 Inspector DON RAMSEY

CORE RUN From	CORE RUN To	Total Run	Core Recovery	Percent Recovery	CLASSIFICATION	PRESSURE TEST Pac. Loc. (Ft.) / Bot Hole(Ft.)	PRESSURE TEST Pressure (Psi)	PRESSURE TEST Infl (Gp
					0.0-13.0' Fill Control Section			
					13.0-27.0'			
27.0	29.5	2.5	2.3	92	Alluvial Deposit-Stratified Sands Gravels W/Silt & Clayey Silt Matrix			
					27.0-34.6'			
29.5	37.0	7.5	7.5	100	Medium Gray, Medium To Massive Bedded, Hard, Dense Medium to Coarsely Crystaline Fossiliferous Limestone W/ Scattered Few Chert Nodules Up to 2" Dimension			
					34.6-35.3' Solid Chert Band			
					35.3-37.0' Medium Gray, Fresh, Medium Crystaline Hard, Dense, Medium Bedded, Styolitic Limestone Fossiliferous			
					37.0' Bottom of Boring Per Client Instruction			

Drilling Fluid CLEAR WATER Casing 27.0' Press. Gage Loc. @ Gr. Surf.

Ground Water Depth 13.0' Date 7-8-69 Method Det. STEEL TAPE

Remarks SEE WATER PRESSURE TEST SHEETS 2 THRU 3

CHART 2-21

TEST DRILLING SERVICE COMPANY

SHEET 2 OF 3
DATE 7-17-69

REPORT OF WATER PRESSURE TESTING IN CORE DRILL HOLES

DAM SITE LAKE ST. LOUIS RIVER PERUQUE CK HOLE NO 3 RIG NO 43
LOCATION OF HOLE PER CLIENT INSTRUCTION
CONTRACTOR TEST DRILLING SERVICE CO. DRILLER C. STEVENS ELEV TOP OF HOLE

DATA ON FLOW TEST

SECTION OF HOLE TESTED				PRESSURE DURING TEST	TIME STARTED	TIME STOPPED	TIME MINUTES	WATER METER READINGS			
TOP		BOTTOM						AT START OF TEST	AT END OF TEST	TOTAL GAL. OF WATER USED	GAL. PER MINUTE
DEPTH	ELEV	DEPTH	ELEV								

REMARKS:
ELEV TOP ROCK—
BOTTOM HOLE—

* UNABLE TO OBTAIN ANY GAGE PRESSURE AT START OF TEST

DATA ON PRESSURE DURATION TEST

SECTION OF HOLE TESTED				GAUGE PRESSURE AT TEST INTERVALS (PSI)					REMARKS
TOP		BOTTOM		AT START OF TEST	15 SECS	30 SECS	45 SECS	60 SECS	
DEPTH	ELEV.	DEPTH	ELEV						
32.0'		37.0'		15	15+	15	15		
32.0'		37.0'					15+		
32.0'		37.0'					15+		
32.0'		37.0'					15+		
32.0'		37.0'					15+		

OBSERVED BY D. L. RAMSEY

CHART 2-22

TEST DRILLING SERVICE COMPANY

PAGE 3 OF 3

DATE 7-17-69

REPORT OF WATER PRESSURE TESTING IN CORE DRILL HOLES

DAM SITE LAKE ST. LOUIS RIVER PERIQUE CK HOLE NO 3 JOB NO 43

LOCATION OF HOLE PER CLIENT INSTRUCTION

CONTRACTOR TEST DRILLING SERVICE CO. DRILLER C. STEVENS ELEV TOP OF HOLE

DATA ON FLOW TEST

SECTION OF HOLE TESTED				PRESSURE DURING TEST	TIME STARTED	TIME STOPPED	TIME MINUTES	WATER METER READINGS			
TOP		BOTTOM						AT START OF TEST	AT END OF TEST	TOTAL GAL OF WATER USED	GAL PER MINUTE
DEPTH	ELEV.	DEPTH	ELEV.								

REMARKS:

ELEV TOP ROCK—

BOTTOM HOLE—

* UNABLE TO OBTAIN ANY GAGE PRESSURE AT START OF TEST

DATA ON PRESSURE DURATION TEST

SECTION OF HOLE TESTED				GAUGE PRESSURE AT TEST INTERVALS (PST)					REMARKS
TOP		BOTTOM		AT START OF TEST	15 SECS	30 SECS	45 SECS	60 SECS	
DEPTH	ELEV.	DEPTH	ELEV.						
27.0		32.0'		25	25	25	25	25	
27.0		32.0'						25	
27.0		32.0'						25	
27.0		32.0'						25	
27.0		32.0'						25	

OBSERVED BY D. L. RAMSEY

CHART 2-23

TEST DRILLING SERVICE COMPANY

SHEET 2 OF 2
DATE 7-20-69

REPORT OF WATER PRESSURE TESTING IN CORE DRILL HOLES

DAM SITE LAKE ST. LOUIS RIVER PERUQUE CK HOLE NO. 4 JOB NO. 43
LOCATION OF HOLE PER CLIENT INSTRUCTION
CONTRACTOR TEST DRILLING SERVICE CO. DRILLER C. STEVENS ELEV. TOP OF HOLE

DATA ON FLOW TEST

SECTION OF HOLE TESTED				PRESSURE DURING TEST	TIME STARTED	TIME STOPPED	TIME MINUTES	WATER METER READINGS			
TOP		BOTTOM									
DEPTH	ELEV	DEPTH	ELEV					AT START OF TEST	AT END OF TEST	TOTAL GAL OF WATER USED	GAL PER MINUTE

REMARKS:
ELEV TOP ROCK~
BOTTOM HOLE~

X UNABLE TO OBTAIN ANY GAGE PRESSURE AT START OF TEST

DATA ON PRESSURE DURATION TEST

SECTION OF HOLE TESTED				GAUGE PRESSURE AT TEST INTERVALS (PSI)					REMARKS
TOP		BOTTOM		AT START OF TEST	15 SECS	30 SECS	45 SECS	60 SECS	
DEPTH	ELEV.	DEPTH	ELEV						
37.5		42.5		18	18+	18+	18+	19-	
37.5		42.5						19-	2 MIN
37.5		42.5						19-	3 MIN
37.5		42.5						19	4 MIN
37.5		42.5						19	5 MIN

OBSERVED BY D. L. RAMSEY

CHART 2-25

DRILLING SERVICE COMPANY

PHONE: 314-731-1111 5121 NO. LINDBERGH BLVD. BRIDGETON, MO. 63042 ST. LOUIS COUNTY

FIELD BORING LOG

Project LAKE ST. LOUIS Job No. 247

Boring 4 Location PER CLIENT INSTRUCTION Surface El 487.7

Drilling Co. TEST DRILLING SERVICE CO. Boring Type NXM CORE

Date 7-9-69 Rig 63 Inspector DON RAMSEY

CORE RUN From	CORE RUN To	Total Run	Core Recovery	Percent Recovery	CLASSIFICATION	PRESSURE TEST Pac. Loc. (Ft.) / Bot Hole (Ft.)	Pressure (Psi)	Inflow (Gpm)
					0.0-37.0' Control Fill Section			
					Free Water Entry @ Contact W/Bedrock			
37.0	42.5	5.5	5.5	100	37.0-42.5' Fresh Medium Gray, Thin to Medium Bedded, Coarsely Crystalline, Hard, Dense, Fossiliferous Stylolitic Limestone W/Scattered Few Nodules of Chert			
					042.5' Stopped HOle Due to Very Hard Chert Inclusion Which Could Not be Cored			

Drilling Fluid CLEAR WATER Casing 37' Press. Gage Loc. Gr. Surface

Ground Water Depth 23.0' Date 7-9-69 Method Det. STEEL TAPE

Remarks SEE WATER PRESSURE TESTING SHEET 2 of 2

CHART 2-24

TEST DRILLING SERVICE Company

Soil Sampling
Core Drilling
Site Explorations
Pressure Grouting
Geological Investigations

5121 NO. LINDBERGH BLVD. • BRIDGETON, MO. 63042 • 314-731-1111

July 1, 1970

Horner & Shifrin, Inc.
5200 Oakland
St. Louis, Missouri 63110

Attention: Mr. Donald C. Lochmoeller

RE: Core Drilling Report
For Spillway Design
Lake St. Louis
St. Charles County

Gentlemen:

We are submitting three (3) copies of our core boring report pertaining to the subject project site.

A total of eleven (11) detailed core borings were drilled at your direction and are shown on the site plan, Figure 1. Our boring logs, Figure 2 thru 12 present the detailed description of the material encountered and the core recovery records. Special notes on loss of drill water circulation are reported for each boring drilled.

We hope the information enclosed is as complete as you desire. If you have any questions concerning this information, please contact us at your convenience and we will be more than happy to meet with you. Thank you for calling on Test Drilling Service Company for this work.

With Best Regards,

TEST DRILLING SERVICE COMPANY

Donald L. Ramsey
Vice-President

DLR/bh

Enc.-

TEST DRILLING REPORT

DRILLING SERVICE CO.

5121 NO. LINDBERGH BLVD. • 314-731-1111 • BRIDGETON, MO. 63042

Client Horner & Shifrin Date of Report 7-1-70

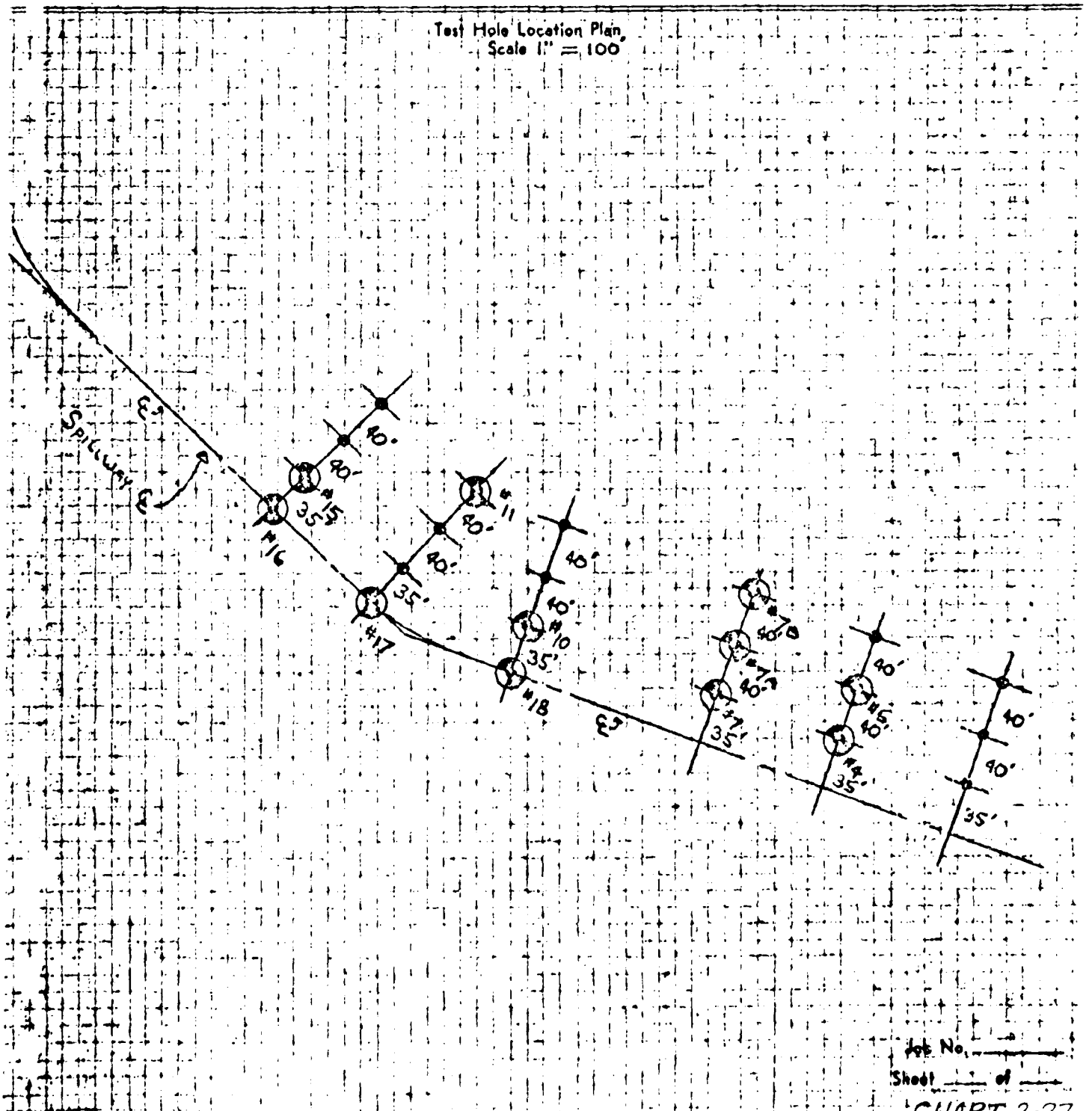
Address 5200 Oakland, St. Louis, Missouri 63110

We Have Completed Exploratory Test Drilling Work For You at

Lake St. Louis Spillway

As Outlined Below. Detailed Results of All Boring Is Attached Hereto.

Test Hole Location Plan
Scale 1" = 100'



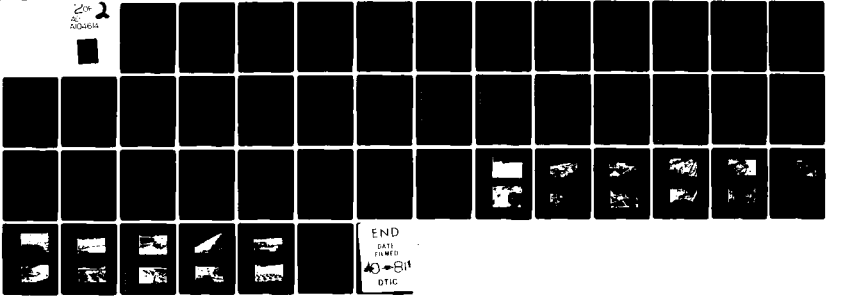
Job No.

Sheet ___ of ___

CHART 2-27

AD-A104 614 HORNER AND SHIFRIN INC ST LOUIS MO F/G 13/13
NATIONAL DAM SAFETY PROGRAM. LAKE ST. LOUIS DAM (MO 10545) MISS--ETC(U)
MAY 78 DACW43-79-C-0047
UNCLASSIFIED NL

2 OF 2
AD A104614



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DRILLING SERVICE COMPANY

PHONE: 314-731-1111 5121 NO. LINDBERGH BLVD. BRIDGETON, MO. 63042 ST. LOUIS COUNTY

FIELD BORING LOG

Project LAKE ST. LOUIS - SPILLWAY CORING Job No. 70-62

Boring 4 Location 11+20, 35' LEFT Surface El. 488.73'

Drilling Co. TEST DRILLING SERVICE CO. Boring Type AX CORE

Date 6-5-70 Rig CME NO. 59 Inspector L.L.B.

CORE RUN From	CORE RUN To	Total Run	Core Recovery	Percent Recovery	CLASSIFICATION	PRESSURE TEST Exc. Loc. (Ft.) / Pot. Hole (Ft.)	Pressure (Psi)	Inflow (Gpm)
3-4	5-2	28"	20"	71	0'0"-3'1" Broken rock			
3-4	13-4	92"	87"	93	3'1"-10'10" Gray limestone w/ trace chert & occa. 1" decomposed seam			
13-4	23-4	120"	102"	91	10'10"-23'6" Gray limestone w/ chert inclusions up to 3" thick			
23-4	33-4	120"	119"	99				
33-4	38-2	77"	60"	78	23'6"-31'2" Gray to gray buff, slightly fractured, silty limestone w/ occa. chert inclusions up to 2" thick			
					31'2"-32'9" Gray limestone w/ chert inclusions up to 3" thick & occa. thin, decomposed seams			
					32'9" Bottom of boring			

Drilling Fluid CLEAR WATER Casing 3 1/4" Press. Gage Loc.

Ground Water Depth Date Method Det.

Remarks No drill water circulation loss throughout coring operations.

CHART 2-28

FIG. 2

DRILLING SERVICE COMPANY

PHONE: 314-731-1111 5121 NO. LINDBERGH BLVD. BRIDGETON, MO. 63042 ST. LOUIS COUNTY

FIELD BORING LOG

Project LAKE ST. LOUIS - SPILLWAY CORING Job No. 72-62

Boring 5 Location 11+00, 75' LEFT Surface El 498.5'

Drilling Co. TEST DRILLING SERVICE CO. Boring Type AX CORE

Date 6-6-70 Rig CME NO. 59 Inspector D.L.R.

CORE RUN (el 5) From	To	Total Run	Core Recovery	Percent Recovery	CLASSIFICATION	PRESSURE TEST Pac. Loc. (Ft.) / Bot. Hole (Ft.)	Pressure (Psi)	Inflow (Cpm)
0-2	2-3	20"	13"	65	0'0"-0'4" Broken shot rock			
2-3	12-1	113"	54"	47	0'4"-1'2" Gray limestone w/ thin chert inclusions			
12-1	22-1	120"	116"	97	1'2"-2'0" Decomposed limestone			
22-1	32-1	120"	16"	13	2'0"-6'7" Gray limestone w/ trace chert			
32-1	39-9	80"	13"	16	6'7"-11'6" Decomposed limestone			
					11'6"-23'5" Gray limestone w/ chert inclusions up to 5" thic.			
					23'5"-38'9" Buff, highly weathered, silty decomposed limestone			
					38'9" Bottom of boring per client instructions			

Drilling Fluid CLEAR WATER Casing NONE Press. Gage Loc. _____

Ground Water Depth _____ Date _____ Method Det. _____

Remarks No drill water circulation loss throughout drilling operations.

CHART 2-29

FIG 3

DRILLING SERVICE COMPANY

PHONE: 314-731-1111 5121 NO. LINDBERGH BLVD. BRIDGETON, MO. 63042 ST. LOUIS COUNTY

FIELD BORING LOG

Project LAKE ST. LOUIS - SPILLWAY CORING Job No. 70-69
Boring 7 Location 10+00, 35' LEFT Surface El 439.0'
Drilling Co. TEST DRILLING SERVICE CO. Boring Type AX CORE
Date 5-27-70 Rig CME NO. 59 Inspector D.L.R.

CORE RUN (Ft.-In.) From	To	Total Run	Core Recovery	Percent Recovery	CLASSIFICATION	PRESSURE TEST Pac. Loc. (Ft.) / Bot. Hole (Ft.)	Pressure (Psi)	Inflow (Gpm)
1-5	6-7	62"	56"	90	0'0"-1'5" Overburden - Broken shot rock			
6-7	12-4	69"	65"	76	1'5"-3'3" Buff gray, slightly weathered limestone w/ chert inclusions up to 3" thick - Decomposed section betw. 2'9" & 3'3"			
12-3	27-4	97"	97"	100	3'3"-12'1" Gray limestone w/ trace chert			
27-4	35-9	101"	101"	100	12'1"-27'2" Gray limestone w/ chert inclusions up to 3" thick - Decomposed sections betw.: 12'1"-12'11" 13'1"-13'5" 15'3"-15'8" 16'2"-16'8"			
35-9	39-0	39"	38"	98	NOTE: 10% water circulation loss betw. 12'1" & 16'8" run			
					27'2"-30'8" Buff gray, slightly weathered limestone w/ occa. chert inclusions up to 2" thick			
					30'8"-35'10" Gray limestone w/ chert inclusions up to 3" thick			
					35'10"-35'12" Buff gray, slightly weathered silty limestone w/ trace chert			
					35'12"-39'0" Gray limestone w/ chert inclusions up to 3" thick			
					39'0" Bottom of boring			
					NOTE: 20% water circulation loss betw. 27'4" & 35'9" run			

Drilling Fluid CLEAN WATER Casing NONE Press. Gage Loc. _____
Ground Water Depth _____ Date _____ Method Det. _____
Remarks _____

CHART 2-30
FIG. 4

DRILLING SERVICE COMPANY

PHONE: 314-731-1111 — 5121 NO. LINDBERGH BLVD. BRIDGETON, MO. 63042 — ST. LOUIS COUNTY

FIELD BORING LOG

Project LAKE ST. LOUIS - SPILLWAY CORING Job No. 70-69
Boring 7-A Location 10+00, 75' LEFT Surface El 498.7'
Drilling Co. TEST DRILLING SERVICE CO. Boring Type 'N' & AX CORE
Date 5-12-70 & 6-2-70 Rig CME NO. 59 Inspector D.L.L.

CORE RUN (Ft.-In.) From	To	Total Run	Core Recovery	Percent Recovery	CLASSIFICATION	PRESSURE TEST Pressure Loc. (Ft.) / Bot. Hole (Ft.)	Pressure (Psi)	Inflow (Gpm)
C-6	5-0	54"	44"	82	0'0"-0'5" Overburden - Broken rock & clay			
5-0	9-6	54"	54"	100	0'6"-1'1" Gray limestone w/ trace chert			
9-6	15-7	73"	73"	100	1'1"-1'10" Decomposed limestone			
15-7	25-7	120"	70"	58	1'10"-2'10" Gray limestone w/ occa. thin chert inclusions			
25-7	32-10	37"	20"	57				
32-10	39-0	74"	54"	73	2'10"-2'17" Gray limestone w/ chert inclusions up to 8" thick & soft decomposed seams bet". 1'7" - 1'13" 1'13" - 1'8" 2'10" - 2'1" 2'15" - 2'1" 2'13" - 2'17"			
					2'17"-39'0" Buff to buff gray, slightly weathered silty limestone w/ chert inclusions up to 3" thick & decomposed seams bet". 2'13" - 2'7" 2'10" - 2'16" 2'11" - 3'10" 3'6" - 3'10" 3'12" - 36'0"			
					39'0" Bottom of boring			

Drilling Fluid CLEAR WATER Casing NONE Press. Gage Loc. _____
Ground Water Depth _____ Date _____ Method Det. _____
Remarks Used 'N' Core to 15'7" on 5-12-70, then changed to AX Core to 39'0" on 6-2-70.
No drill water circulation loss throughout coring operations.

CHART 23

DRILLING SERVICE COMPANY

PHONE: 314-731-1111 | 5121 NO. LINDBERGH BLVD. BRIDGETON, MO. 63042 | ST. LOUIS COUNTY

FIELD BORING LOG

Project LAKE ST. LOUIS - SPILLWAY CORING Job No. 70-60
Boring T-B Location 10+00, 115' LWT Surface El 425.7'
Drilling Co. TEST DRILLING SERVICE CO. Boring Type 4" CORE
Date 5-28-70 Rig CME NO. 52 Inspector D.L.B.

CORE RUN (Ft-In) From	To	Total Run	Core Recovery	Percent Recovery	CLASSIFICATION	PRESSURE TEST Fac. Loc. (Ft.) / Bot. Hole (Ft.)	Pressure (Psi)	Inflow (Gpm)
1-6	11-7	121"	64"	53	3'10"-11'6" Overburden - Shot rock			
11-7	21-9	122"	100"	82	11'6"-21'6" Gray limestone w/ trace chert & soft decomposed seams below. 11'6"-12'0" 12'0"-13'1" 13'1"-13'10" 13'10"-16'10" 16'10"-18'10"			
21-9	26-1	98"	42"	43				
26-1	31-8	70"	60"	86				
					21'6"-27'3" Gray limestone w/ chert inclusions up to 6" thick & soft decomposed seams below. 21'6"-22'6" 22'8"-23'3" 25'3"-25'10" 26'11"-31'5"			
					27'3"-35'9" Gray decomposed limestone w/ chert inclusions up to 2" thick			
					35'9" Bottom of boring			

Drilling Fluid CLEAR WATER Casing 11'6" Press. Gage Loc.
Ground Water Depth Date Method Det.
Remarks No drill water circulation loss throughout the coring operations.

CHART 2-32

FTC. 6

DRILLING SERVICE COMPANY

PHONE: 314-731-1111 5121 NO. LINDBERGH BLVD. BRIDGETON, MO. 63042 ST. LOUIS COUNTY

FIELD BORING LOG

Project LAKE ST. LOUIS - SPILLWAY CORING Job No. 70-62

Boring 10 Location 8+75, 25' LEFT Surface El 497.8'

Drilling Co. TEST DRILLING SERVICE CO. Boring Type AX CORE

Date 5-26-70 Rig CME NO. 52 Inspector D.L.B.

CORE RUN (Ft-In) From	To	Total Run	Core Recovery	Percent Recovery	CLASSIFICATION	PRESSURE TEST Pac. Loc. (Ft.) / Bot. Hole (Ft.)	Pressure (Psi)	Inflow (Com)
1-0	1-1	1'1"	1'1"	100	0'0"-1'0" Overburden - Loose shot rock			
1-1	6-1	60"	58"	97	1'0"-11'1" Gray limestone w/ trace chert			
6-11	10-3	100"	100"	100	11'1"-25'9" Gray limestone w/ numerous chert inclusions up to 6" thick			
10-3	26-5	96"	96"	100				
26-5	33-2	93"	93"	100	25'9"-32'10" Buff gray to buff, slightly calcareous, silty limestone w/ chert inclusions up to 2" thick			
33-2	38-0	58"	56"	97	32'10"-38'10" Gray limestone w/ chert inclusions 1" to 3" thick			
					38'10" Bottom of boring			
					NOTE: No water circulation loss throughout coring operations			

Drilling Fluid CLEAR WATER Casing NONE Press. Gage Loc.

Ground Water Depth Date Method Det.

Remarks

CHART 2-33

FTG. 7

DRILLING SERVICE COMPANY

PHONE: 314-731-1111 5121 NO. LINDBERGH BLVD. BRIDGETON, MO. 63042 ST. LOUIS COUNTY

FIELD BORING LOG

Project LAKE ST. LOUIS - SPILLWAY CORING Job No. 70-69
Boring 11 Location 7+50, 115' LEFT Surface El 518.5'
Drilling Co. TEST DRILLING SERVICE CO. Boring Type AX CORE
Date 6-22-70 Rig CME NO. 59 Inspector D.L.R.

CORE RUN From	CORE RUN To	Total Run	Core Recovery	Percent Recovery	CLASSIFICATION	PRESSURE TEST Pac. Loc. (Ft.) / Bot. Hole (Ft.)	Pressure (Psi)	Inflow (Gpm)
					0'0"-34'3" Overburden			
34-3	44-3	120"	50"	42	34'3"-44'3" Gray to buff gray limestone w/ numerous decomposed horizons			
					44'3"-Bottom of boring per client instruction			

NOTES:
1) 50% drill water circulation loss between 34'3" & 44'3"
2) 100% drill water circulation loss @ 44'3"(±)

Drilling Fluid CLEAR WATER Casing 34'3" Press. Gage Loc. _____
Ground Water Depth _____ Date _____ Method Det. _____
Remarks _____

CHART 2-34

DRILLING SERVICE COMPANY

PHONE: 314-731-1111 — 5121 NO. LINDBERGH BLVD. BRIDGETON, MO. 63042 — ST. LOUIS COUNTY

FIELD BORING LOG

Project LAKE ST. LOUIS - SPILLWAY CORING — Job No. 70-69
Boring 15 — Location 6+50, 35' LEFT — Surface El 425.3'
Drilling Co. TEST DRILLING SERVICE CO. — Boring Type AX CORE
Date 5-25-70 — Rig CME NO. 59 — Inspector D.L.R.

CORE RUN From	CORE RUN To	Total Run	Core Recovery	Percent Recovery	CLASSIFICATION	PRESSURE TEST Sec. Loc. (Ft.) / Ext. Hole (Ft.)	Pressure (Psi)	Inflow (Gpm)
2-0	1-2	20"	20"	77	5'0"-21'0" Overburden			
1-2	2-3	12"	12"	0%	21'0"-21'10" Gray limestone - Trace chert w/ thin, buff partings			
2-3	3-4	10"	10"	100				
3-4	4-5	10"	10"	100				
4-5	5-6	10"	60"	100	21'10"-31'2" Soft, decomposed limestone - Lost water circulation			
5-6	6-7	10"	35"	58%	31'2"-41'8" Gray limestone - Trace chert w/ thin, buff partings			
6-7	7-8	10"	60"	100				
7-8	8-9	10"	56"	100	(10'3" - Set 11" casing to 41'2")			
41-2	42-3	16"	16"	100	41'8"-51'1" Soft, decomposed limestone - No water loss			
					51'1"-51'8" Gray limestone - Trace chert w/ thin, buff partings			
					51'8"-61'2" Soft, decomposed limestone - No water loss			
					61'2"-251'7" Gray limestone w/ chert inclusions up to 8" thick			
					251'7"-271'8" Buff, weathered, silty limestone - Lost 30% water return			
					271'8"-331'2" Gray limestone w/ chert inclusions up to 4" thick - Vertical fracture throughout section			
					331'2"-351'4" Buff gray limestone w/ chert inclusions to 6" thick			
					351'4" Bottom of boring			

Drilling Fluid Clear water — Casing 41'2" — Press. Gage Loc. ____
Ground Water Depth ____ Date ____ Method Det. ____
Remarks * Bearings on core barrel were damaged on this run - Formation cored solid w/ poor recovery due to grinding core
No drill water circulation loss throughout coring operations. CHART 2-35

PTO. 9

DRILLING SERVICE COMPANY

PHONE: 314-731-1111 6121 NO. LINDBERGH BLVD. BRIDGETON, MO. 63042 ST. LOUIS COUNTY

FIELD BORING LOG

Project LAKE ST. LOUIS - SPILLWAY CORING Job No. 70-69
Boring 16 Location 6+50 ON CENTERLINE Surface El 495.7'
Drilling Co. TEST DRILLING SERVICE CO. Boring Type AX CORE
Date 5-25-70 Rig CME NO. 59 Inspector D.L.B.

CORE RUN (Elev. or Depth) From	To	Total Run	Core Recovery	Percent Recovery	CLASSIFICATION	PRESSURE TEST Puc. Loc. (Ft.) / Det. Hole (Ft.)	Pressure (Psi)	Inflow (Gpm)
0=0	1=0	57"	56"	98	0'0"-1'11" Gray limestone w/ trace chert. Argil material			
1=0	2=0	60"	60"	100				
2=0	3=7	22"	22"	100	1'11"-2'11" Gray limestone w/ chert inclusions up to 8" thick - Argil material			
3=7	4=7	62"	58"	94				
4=7	5=9	60"	60"	100	2'11"-35'0" Buff gray to buff, slightly weathered limestone w/ numerous fossil inclusions to 3" thick & occa. thin vertical fractures			
5=9	6=9	60"	57"	95				
6=9	7=9	60"	60"	100	(10' water circulation loss)			
7=9	8=9	60"	60"	100				
8=9	9=9	48"	48"	100	35'0" Bottom of boring			

Drilling Fluid CLEAR WATER Casing NONE Press. Gage Loc.
Ground Water Depth Date Method Det.
Remarks No drill water circulation loss throughout coring operations.

CHART 2-36

DRILLING SERVICE COMPANY

PHONE: 314-731-1111 5121 NO. LINDBERGH BLVD. BRIDGETON, MO. 63042 ST. LOUIS COUNTY

FIELD BORING LOG

Project LAKE ST. LOUIS - SPILLWAY CORING Job No. 70-69

Boring 17 Location 7+50 ON CENTERLINE Surface El 497.6'

Drilling Co. TEST DRILLING SERVICE CO. Boring Type AX CORE

Date 5-19-70 Rig CME NO. 59 Inspector D.L.B.

CORE RUN From	CORE RUN To	Total Run	Core Recovery	Percent Recovery	CLASSIFICATION	PRESSURE TEST Pac. Loc. (Ft.) / Bot. Hole (Ft.)	Pressure (Psi)	Inflow (Gpm)
0-0	2-10	5'0"	5'0"	100	0'0"-2'6" Gray limestone w/ numerous chert inclusions up to 4" thick & soft			
2-10	7-10	5'0"	5'0"	100	fossiliferous seams.			
7-10	12-10	6'0"	4'2"	70	2'6"-3'1"			
12-10	17-10	6'0"	6'0"	100	3'1"-9'1"			
17-10	22-10	6'0"	6'0"	100	9'1"-15'1"			
22-10	27-10	6'0"	6'0"	100	15'1"-21'1"			
27-10	32-10	6'0"	5'2"	93	21'1"-26'1"			
32-10	35-10	3'0"	2'9"	93	26'1"-29'1"			
35-10	37-3	2'3"	2'7"	92	29'1"-37'3" Buff gray to buff, slightly weathered silty limestone w/ numerous chert inclusions up to 5" thick			
					37'3" Bottom of boring			
					NOTE: No water circulation loss throughout core operations			

Drilling Fluid CLEAR WATER Casing NONE Press. Gage Loc. _____

Ground Water Depth _____ Date _____ Method Dot. _____

Remarks _____

CHART 2-37

ETO 11

DRILLING SERVICE COMPANY

PHONE: 314-731-1111 5121 NO. LINDBERGH BLVD. BRIDGETON, MO. 63042 ST. LOUIS COUNTY

FIELD BORING LOG

Project LAKE ST. LOUIS - SPILLWAY CORING Job No. 70-69

Boring 12 Location 8+75 ON CENTERLINE Surface El 483.1'

Drilling Co. [illegible] DRILLING SERVICE CO. Boring Type AX CORE

Date 6-3-70 Rig CME NO. 59 Inspector D.L.R.

CORE RUN ([illegible]) From	To	Total Run	Core Recovery	Percent Recovery	CLASSIFICATION	PRESSURE TEST Pac. Loc. (Ft.) / Bot. Hole (Ft.)	Pressure (Psi)	Inflow (Gpm)
1-7	4-0	29"	27"	93	[illegible]-1'7" Broken shot rock			
4-0	11-0	84"	31"	37	1'7"-[illegible] Gray limestone w/ occas. thin chert seams			
11-0	19-9	105"	8"	.1	[illegible] Buff, weathered decomposed limestone w/ numerous chert inclusions			
19-9	29-9	120"	104"	87				
29-9	38-2	101"	94"	93	[illegible] Gray to buff gray limestone w/ chert inclusions up to 5" thick & one decomposed seam betw. 28'4" to 29'8"			
					38'2" Bottom of boring per client instruction			

Drilling Fluid CLEAR WATER Casing 1'7" Press. Gage Loc.

Ground Water Depth Date Method Det.

Remarks No drill water circulation loss throughout coring operations.

CHART 2-38

FIG. 12

LOG OF BORING NO. 101

[redacted]

PHONE: (314) 291-1111 2203 DRILLING SERVICE DR. MARYLAND HEIGHTS, MO. 63043
ST. LOUIS COUNTY

PROJECT Yale St. Levee JOB NO. 71-63

BORING LOCATION Skillman Extension SURFACE EL. 498.4

DATE: (START) 5-9-71 (FINISH) 5-11-71 RIG: B10 INSPECTOR:

DEPTH FROM	DEPTH TO	CLASSIFICATION	DATE	TIME	CORE RUN FROM	CORE RUN TO	TOTAL RUN	RECOVERY TOTAL	RECOVERY %
0.0	0.5	Residual Red Clay & Chert Gravel			0.5'	5.5'	5.0'	5.0'	100
0.5	40.0'	LIGHT Gray, Hard, Dense Limestone W/Numerous			5.5'	10.5'	5.0'	5.0'	100
		Chert Inclusions			10.5'	15.5'	5.0'	5.0'	100
					15.5'	20.5'	5.0'	5.0'	100
		Between 21.5 & 28.0' W/Buff Weathered			20.5'	24.5'	4.0'	4.0'	100
		Portions			24.5'	28.7'	4.2'	4.2'	100
					28.7'	38.7'	10.0'	10.0'	100
	40.0'	Bottom of Boring			38.7'	40.0'	1.3'	1.3'	100

REMARKS: No water loss while drilling

CHART 2-39

LOG OF BORING NO. [illegible]

[illegible] DRILLING SERVICE CO.

PHONE: (314) [illegible]-1111 2000 DRILLING SERVICE DR. MARYLAND HEIGHTS, MO. 63043
ST. LOUIS COUNTY

PROJECT: [illegible] St. Louis JOB NO. [illegible]

BORING LOCATION: [illegible] Section SURFACE EL. 501.6

DATE: START: [illegible]-71 FINISH: [illegible]-71 RIG: [illegible] INSPECTOR:

DEPTH FROM	DEPTH TO	CLASSIFICATION	DATE	TIME	CORE RUN FROM	CORE RUN TO	TOTAL RUN	RECOVERY TOTAL	RECOVERY %
0.0	1.0'	Broken Weathered Limestone			1.0'	5.0'	[illegible]	1.5'	37
[illegible]	[illegible]	Light Gray, Hard, Dense, Limestone W/[illegible]			5.0'	9.8'	4.8'	4.0'	93
		Chert Inclusions			9.8'	14.5'	4.7'	[illegible]	96
					14.5'	20.2'	5.7'	5.7'	100
	[illegible].0'	Bottom of Boring			20.2'	21.5'	1.3'	0.5'	38
					21.5'	31.3'	9.8'	7.5'	77
					31.3'	33.4'	2.1'	2.0'	95
					33.4'	[illegible]	[illegible]	[illegible]	100
					[illegible]	[illegible]	[illegible]	[illegible]	100

REMARKS: Chert layers caused some core grinding.
No water loss while drilling

CHART 2-40

LOG OF BORING NO. 102

PHONE: (314) 201-1111 2000 DRILLING SERVICE DR. MARYLAND HEIGHTS, MO. 63043
ST. LOUIS COUNTY

PROJECT [illegible] SURFACE EL. 501.6

FROM	TO	CLASSIFICATION	DATE	TIME	CORE RUN FROM	CORE RUN TO	CORE RUN TOTAL	RECOVERY TOTAL	RECOVERY %
0.0	1.0'	Broken Weathered Limestone			1.0'	5.0'	4.0'	1.5'	37
1.0'	5.0'	Light Gray, Hard, Dense, Limestone Interbeds			5.0'	9.8'	4.8'	4.8'	98
		Light Fracturing			9.8'	14.5'	4.7'	4.6'	96
					14.5'	20.2'	5.7'	5.7'	100
	17.0'	Bottom of Ramina			20.2'	21.5'	1.3'	0.5'	38
					21.5'	31.3'	9.8'	7.5'	77
					31.3'	33.4'	2.1'	2.0'	95
					33.4'	38.0'	4.6'	4.6'	99
					38.0'	43.2'	5.2'	5.2'	100

REMARKS: Chert layers caused some core grinding.
No water loss while drilling

CHART 2-41

LOG OF BORING NO. 103

TEST DRILLING SERVICE CO.

PHONE: (314) 291-1111 2000 DRILLING SERVICE DR. MARYLAND HEIGHTS, MO. 63043
ST. LOUIS COUNTY

PROJECT Lake St. Louis JOB NO. 71-33

BORING LOCATION Spillway Section SURFACE EL. 513.8

DATE: (START) 7-8-71 (FINISH) 7-9-71 RIG: 719 INSPECTOR:

DEPTH FROM	DEPTH TO	CLASSIFICATION	DATE	TIME	CORE RUN FROM	CORE RUN TO	TOTAL RUN	RECOVERY TOTAL	RECOVERY %
0.0	5.0'	Residual Red Clay & Chert Gravel			10.5'	15.0'	4.5'	4.5'	100
					15.0'	17.2'	2.2'	2.0'	91
5.0	7.0'	Chert Boulder			17.2'	19.1'	1.9'	1.9'	100
					19.1'	25.7'	6.6'	6.6'	100
7.0	9.0'	Yellow, Soft Shaly Clay Layer			25.7'	27.2'	1.5'	1.5'	100
					27.2'	32.9'	5.7'	5.7'	100
9.0	10.5'	Weathered, Soft Limestone			32.9'	38.7'	5.8'	5.8'	100
[illegible]					38.7'	43.7'	5.0'	4.0'	80
10.5	53.0'	Light Gray W/Some Weathered Buff Portions,			43.7'	46.0	2.3'	2.3'	100
		Hard, Dense Limestone W/Numerous Chert In-			46.0'	53.0'	7.0'	7.0'	100
		clusions							
	53.0'	Bottom of Boring							

REMARKS: No water loss while drilling.

CHART 2-42

LOG OF BORING NO. 108

TEST DRILLING SERVICE CO.

PHONE: (314) 291-1111 2300 DRILLING SERVICE DR. MARYLAND HEIGHTS, MO. 63043
ST. LOUIS COUNTY

PROJECT: Time St. Louis JOB NO. 71-63

BORING LOCATION: Drilling Section SURFACE EL. 500.0

DATE: (START) 6-11-71 (FINISH) 6-15-71 RIG: 719 INSPECTOR:

DEPTH FRO	DEPTH TO	CLASSIFICATION	DATE	TIME	CORE RUN FROM	CORE RUN TO	TOTAL RUN	RECOVERY TOTAL	RECOVERY %
0.0	10.0'	Residual Red Clay & Chert Gravel W/Several			10.0'	15.0'	5.0'	3.0'	60
		Large Boulders or Stratified Lenses of Chert			15.0'	16.5'	1.5'	1.0'	67
		& Limestone Below 5.0'			16.5'	18.0'	1.5'	1.3'	87
18.0	34.7'	Lt. Grey, Thin Bedded Limestone W/Numerous			18.0'	26.0'	8.0'	3.0'	37
		Clay Layers & Chert Inclusions (Chert Fell			26.0'	28.5'	2.5'	4.3'	12
		In From Seams Caused Core Grinding)			28.5'	34.7'	6.2'	1.7'	27
34.7'		Lost Diamond Bit in Hole-							
		Sharp Chert Cut off Outer							
		Barrel							
	34.7	Bottom of Boring							

REMARKS: No water loss during drilling.

CHART 2-43

LOG OF BORING NO. 125

[illegible] DRILLING SERVICE CO.

PHONE: (314) 291-1111 2300 DRILLING SERVICE DR. MARYLAND HEIGHTS, MO. 63043
ST. LOUIS COUNTY

PROJECT [illegible] St. Louis JOB NO. 71-63

BORING LOCATION: [illegible] Section SURFACE EL. 501.2

DATE: (START) 5-17-71 (FINISH) 6-18-71 RIG: 719 INSPECTOR:

DEPTH FROM	DEPTH TO	CLASSIFICATION	DATE	TIME	CORE RUN FROM	CORE RUN TO	TOTAL RUN	RECOVERY TOTAL	RECOVERY %
0.0	7.5'	Residual Red Clay & Chert Gravel W/Several			7.6'	8.5'	0.9'	0.9'	100
		Large Boulders or Stratified Ledges of Chert			8.5'	13.1'	4.6'	4.6'	100
		& Limestone Below 3.0'			13.1'	18.1'	5.0'	5.0'	100
471.2 [illegible]	[illegible]	Lt. Gray, Hard, Dense, Limestone			18.1'	23.1'	5.0'	5.0'	100
		w/ Numerous Chert Inclusions			23.1'	28.1'	5.0'	5.0'	100
					28.1'	29.9'	1.8'	1.8'	100
		Between 25.0' & 29.0' w/ Fair Weathered			29.9'	34.9'	5.0'	5.0'	100
		Fractures			34.9'	40.0'	5.1'	5.1'	100
		[illegible] Bottom of Boring							

REMARKS: No water loss during drilling

CHART 2-44

LOG OF BORING NO. 106

TEST DRILLING SERVICE CO.

PHONE: (314) 291-1111 2000 DRILLING SERVICE DR. MARYLAND HEIGHTS, MO. 63043
ST. LOUIS COUNTY

PROJECT Lake St. Louis JOB NO. 71-63

BORING LOCATION Spillway Section SURFACE EL. 504.4

DATE: (START) 6-21-71 (FINISH) 6-22-71 RIG: 719 INSPECTOR:

DEPTH FROM	DEPTH TO	CLASSIFICATION	DATE	TIME	CORE RUN FROM	CORE RUN TO	TOTAL RUN	RECOVERY TOTAL	RECOVERY %
0.0	0.5'	Residual Red Clay & Chert Gravel			6.4'	10.2'	3.8'	3.8'	100
0.5	1.5'	Limestone Layer			10.2'	10.8'	0.6'	0.6'	100
1.5	5.0'	Yellow Clay W/Chert Gravel			10.8'	12.7'	1.9'	1.9'	100
5.0	6.4'	Broken Cherty Limestone			12.7'	17.7'	5.0'	5.0'	100
6.4	45.0'	Light Gray, Hard, Dense			17.7'	22.7'	5.0'	5.0'	100
		Limestone w/ Numerous Chert			22.7'	27.7'	5.0'	5.0'	100
		Nodules			27.7'	32.7'	5.0'	5.0'	100
	45.0'	Bottom of Boring			32.7'	37.7'	5.0'	5.0'	100
					37.7'	42.7'	5.0'	5.0'	100
					42.7'	45.0'	2.3'	2.3'	100

REMARKS: Water loss not noticeable while drilling. Water at 17' after 24 hrs.

CHART 2-45

LOG OF BORING NO. 227

TEST DRILLING SERVICE CO.

PHONE: (314) 291-1111 2300 DRILLING SERVICE DR. MARYLAND HEIGHTS, MO. 63043
ST. LOUIS COUNTY

PROJECT Lake St. Louis JOB NO. 71-60

BORING LOCATION Spillway Section SURFACE EL. 506.8

DATE: (START) 6-16-71 (FINISH) 6-17-71 RIG: 719 INSPECTOR:

DEPTH FROM	DEPTH TO	CLASSIFICATION	DATE	TIME	CORE RUN FROM	CORE RUN TO	TOTAL RUN	RECOVERY TOTAL	RECOVERY %
0.0	7.0	WEATHERED BROKEN LIMESTONE			7.0'	13.7'	6.7'	6.0'	89
		W/ CHERT & RED CLAY LAYERS			13.7'	15.2'	1.5'	1.5'	100
7.0	45.7'	Lt. Grey. Hard. Dense. Limestone			15.2'	22.7'	7.5'	4.2'	53
		w/ Numerous Chert Inclusions			22.7'	27.7'	5.0'	5.0'	100
					27.7'	33.7'	6.0'	5.0'	83
	45.7'	Bottom of Boring			33.7'	38.7'	5.0'	5.0'	100
					38.7'	45.7'	7.0'	7.0'	100

REMARKS: No water loss while drilling. Water at 15' at completion
Some Grinding of Core Due To Chert Ball In

CHART 2-46

LOG OF BORING NO. 108

TEST DRILLING SERVICE CO.

PHONE: (314) 291-1111 2300 DRILLING SERVICE DR. MARYLAND HEIGHTS, MO. 63043
ST. LOUIS COUNTY

Project Lake St. Louis Job No. 71-63

Boring Location Spillway Section Surface El. 514.4

Date: (Start) (Finish) Rig: Inspector:

Depth From	Depth To	Classification	Date	Time	Core Run From	Core Run To	Total Run	Recovery Total	Recovery %
0.0	9.2	Weathered Brown Limestone			9.2'	14.2'	5.0'	5.0'	100
		w/ Some Red Clay Seams			14.2'	19.2'	5.0'	5.0'	100
9.2	53.0'	Light Grey, Hard, Fine,			19.2'	23.2'	3.8'	3.8'	100
		Limestone w/Numerous Chert			23.0'	28.0'	5.0'	5.0'	100
		Inclusions			28.0'	33.0'	5.0'	5.0'	100
					33.0'	38.0'	5.0'	5.0'	100
	53.0'	Bottom of Boring			38.0'	43.0'	5.0'	5.0'	100
					43.0'	44.5'	1.5'	1.5'	100
					44.5'	49.5'	5.0'	5.0'	100
					49.5'	53.0'	3.5'	3.5'	100

REMARKS: No water loss during drilling. Water at 17' after 20 hrs.

CHART 2-47

LOG OF BORING NO. 102

TEST DRILLING SERVICE CO.

PHONE: (314) 291-1111 2800 DRILLING SERVICE DR. MARYLAND HEIGHTS, MO. 63043
ST. LOUIS COUNTY

PROJECT Lake St. Louis JOB NO. 71-63

BORING LOCATION Spillway Section SURFACE EL. 506.0

DATE: (START) 6-22-71 (FINISH) 6-22-71 RIG: 710 (INSPECTOR)

DEPTH FROM	DEPTH TO	CLASSIFICATION	DATE	TIME	CORE RUN FROM	CORE RUN TO	TOTAL RUN	RECOVERY TOTAL	RECOVERY %
0.0	8.0	RESIDUAL RED CLAY & CHERT GRAVEL			10.5'	13.5'	3.0'	[illegible]	7
		W/ BOULDERS AND COBBLES			14.0'	15.2'	1.2'	1.2'	100
		BELOW 4.5'			15.2'	18.1'	2.9'	2.8'	100
8.0	14.0	BROKEN LIMESTONE & CHERT			18.1'	23.1'	5.0'	5.0'	100
					23.1'	28.1'	5.0'	5.0'	100
14.0	45.0'	Light, Gray, Hard, Dense, Limestone,			28.1'	33.1'	5.0'	5.0'	100
		W/ Numerous Chert Inclusions			33.1'	38.1'	5.0'	5.0'	100
					38.1'	43.1'	5.0'	5.0'	100
	45.0'	Bottom of Boring			43.1'	45.0'	1.9'	1.9'	100

REMARKS: Set casing at 10'6" cored to 10'6" - chert, no recovery, pulled casing, reamed to 14', reset casing.

No water loss while drilling - water at 16' after 18 hours.

CHART 2-48

LOG OF BORING NO. 110

[illegible] DRILLING SERVICE CO.

PHONE: (314) 291-1111 2000 DRILLING SERVICE DR. MARYLAND HEIGHTS, MO. 63043
ST. LOUIS COUNTY

PROJECT: Zona St. Louis JOB NO. 71-63

BORING LOCATION: Spillway Section SURFACE EL. 520.2

DATE: (START) 7-12-71 (FINISH) 7-12-71 RIG: 719 INSPECTOR:

DEPTH FROM	DEPTH TO	CLASSIFICATION	DATE	TIME	CORE RUN FROM	CORE RUN TO	TOTAL RUN	RECOVERY TOTAL	RECOVERY %
[illegible]	15.0'	[illegible]			15.0'	19.0'	4.0'	3.0'	75
		[illegible]			19.0'	25.8'	6.8'	6.8'	100
		[illegible]			25.8'	30.8'	5.0'	4.7'	95
		[illegible] 8.5 - 10.0'			30.8'	37.6'	6.8'	6.8'	100
[illegible]	[illegible]	[illegible]			37.6'	43.3'	5.7'	5.7'	100
[illegible]	[illegible]	[illegible]			43.3'	49.6'	6.5'	6.3'	100
18.0	55.0'	Light Gray, Hard, Dense			49.6'	55.0'	5.4'	5.4'	100
		Limestone w/Numerous Chert							
		Nonfossa							
	55.0'	Bottom of Boring							

REMARKS: No water loss during drilling - Some Grinding of Core Due To Chert Ball In

CHART 2-69

LOG OF BORING NO. 112

[illegible] DRILLING SERVICE CO.

PHONE: (314) 291-1111 2000 DRILLING SERVICE DR. MARYLAND HEIGHTS, MO. 63043
ST. LOUIS COUNTY

PROJECT I-64 St. Louis JOB NO. 71-63

BORING LOCATION: [illegible] SURFACE EL. 527.6

DATE: STARTED 1-1-71 FINISHED 2-5-71 RIG: 710 INSPECTOR:

DEPTH FROM	DEPTH TO	CLASSIFICATION	DATE	TIME	CORE RUN FROM	CORE RUN TO	TOTAL RUN	RECOVERY TOTAL	RECOVERY %
0.0	5.0'	RESIDUAL RED CLAY & CHERT GRAVEL			10.0'	15.0'	5.0'	3.7'	74
5.0	10.0'	WEATHERED CHERTY LIMESTONE			15.0'	19.7'	4.7'	3.5'	74
		w/ NUMEROUS RED CLAY SEAMS			19.7'	22.8'	3.1'	3.0'	94
10.0'	26.0'	Light Gray, Hard, Dense			22.8'	26.2'	3.4'	2.5'	76
		Limestone w/ Heavy Weathered			26.2'	29.2'	3.0'	3.0'	100
		Chert Inclusions Seam			29.2'	39.2'	10.0	10.0'	100
		Clay Pockets Noted @			39.2'	41.9'	2.7'	2.7'	100
		Weathered Buff Limestone Horizons			41.9'	51.9'	10.0'	8.5'	85
51.9'	32.0'	Light Gray, Hard, Dense,			51.9'	55.8'	3.9'	2.0'	51
		Limestone w/ Numerous			55.8'	59.2'	3.4'	3.4'	100
		Chert Inclusions			59.2'	62.0'	2.8'	2.7'	100
	32.0'	Bottom of Boring							

REMARKS: No water loss while drilling. Water at 20' at completion.
Core Grinding Due To Chert Fall In

CHART 2-50

LOG OF BORING NO. 113

[redacted] SERVICE CO.

PHONE: (314) 291-1111 2000 DRILLING SERVICE DR. MARYLAND HEIGHTS, MO. 63043
ST. LOUIS COUNTY

PROJECT Lake St. Louis JOB NO. 71-68

BORING LOCATION Spillway Section SURFACE EL. 529.8

DATE: (START) 6-29-71 (FINISH) 6-30-71 RIG: 719 INSPECTOR:

DEPTH FROM	DEPTH TO	CLASSIFICATION	DATE	TIME	CORE RUN FROM	CORE RUN TO	TOTAL RUN	RECOVERY TOTAL	RECOVERY %
6.8	13.0	Residual Red Clay & Chert Gravel			13.0'	18.0'	5.0'	2.0'	40
		w/ some Cobbles			18.0'	23.3'	5.3'	4.5'	85
					23.3'	33.3'	10.0'	10.0'	100
13.0	18.0'	Light Gray thin bedded			33.3'	43.3'	10.0'	10.0'	100
		Limestone w/ Numerous Clay			43.3'	53.3'	10.0'	10.0'	100
		Partings & Weathered Cherty Limestone			53.3'	59.8'	6.5'	6.5'	100
18.0	68.0'	Light Gray, Hard, Dense,			59.8'	66.4'	6.6'	6.6'	100
		Limestone w/Numerous Chert			66.4'	68.0'	1.6'	1.6'	100
		Evaluations							
	68.0'	Bottom of Boring							

REMARKS: No water loss while drilling. Water at 20' at completion.

CHART 2-51

LOG OF BORING NO. 116

TEST DRILLING SERVICE CO.

PHONE: (314) 291-1111 2300 DRILLING SERVICE DR. MARYLAND HEIGHTS, MO. 63043
ST. LOUIS COUNTY

PROJECT Dike St. Louis JOB NO. 71-63

BORING LOCATION Spillway Section SURFACE EL. 512.9

DATE: (START) 6-23-71 (FINISH) 6-24-71 RIG: 719 INSPECTOR:

DEPTH FROM	DEPTH TO	CLASSIFICATION	DATE	TIME	CORE RUN FROM	CORE RUN TO	TOTAL RUN	RECOVERY TOTAL	RECOVERY %
0.0	8.0	Residual Red Clay & Chert Gravel			10.5'	12.3'	1.8'	1.8'	100
8.0	10.5	Weathered Broken Cherty Limestone			12.3'	17.3'	5.0'	5.0'	100
		w/ Numerous Clay Seams			17.3'	22.3'	5.0'	5.0'	100
10.5	54.0'	Light Grey, Hard, Dense			22.3'	27.3'	5.0'	5.0'	100
		Limestone w/ Numerous			27.3'	32.3'	5.0'	5.0'	100
		Chert Inclusions			27.3'	32.3'	5.0'	5.0'	100
	54.0'	Bottom of Boring			32.3'	37.3'	5.0'	5.0'	100
					37.3'	42.3'	5.0'	5.0'	100
					42.3'	47.3'	5.0'	5.0'	100
					47.3'	52.3'	5.0'	5.0'	100
					52.3'	54.0'	1.8'	1.7'	100

REMARKS: No water loss during drilling.

CHART 2-52

LOG OF BORING NO. 116

TEST DRILLING SERVICE CO.

PHONE: (314) 291-1111 2300 DRILLING SERVICE DR. MARYLAND HEIGHTS, MO. 63043
ST. LOUIS COUNTY

PROJECT Lake St. Louis JOB NO. 71-00

BORING LOCATION Spillway Section SURFACE EL. 551.6

DATE: (START) 7-6-71 (FINISH) 7-7-71 RIG: 719 INSPECTOR:

DEPTH FROM	DEPTH TO	CLASSIFICATION	DATE	TIME	CORE RUN FROM	CORE RUN TO	TOTAL RUN	RECOVERY TOTAL	RECOVERY %
		Residual Red Clay & Chert Gravel			12.0'	15.5'	3.5'	3.5'	100
		Weathered Broken Cherty Limestone			15.5'	16.7'	1.2'	0.7'	58
		w/ Numerous Clay Seams & Loss, Thin			16.7'	17.7'	1.0'	1.0'	100
		Open Seams			17.7'	24.5'	6.8'	2.3'	34
		(Lost Some Drilling Circulation)			24.5'	25.5'	1.0'	1.0'	100
12.0	24.0	Light Gray to Buff, thin			25.5'	29.2'	3.7'	3.7'	100
		Bedded Cherty Limestone			39.2'	39.2'	10.0'	10.0'	100
		w/ Numerous Clay Seams			39.2'	49.2'	10.0'	10.0'	100
24.0	55.0'	Light Gray, Hard, Dense, Limestone			49.2'	55.0'	5.8'	5.8'	100
		w/ Numerous Chert Inclusions							
	55.0'	Bottom of Boring							

REMARKS: Slight Water loss between 15' and 20'. No water loss after going hole to 25'

CHART 2-53

LOG OF BORING NO. 117

TEST DRILLING SERVICE CO.

PHONE: (314) 291-1111 2300 DRILLING SERVICE DR. MARYLAND HEIGHTS, MO. 63043
ST. LOUIS COUNTY

PROJECT Lake St. Louis JOB NO. 71-63

BORING LOCATION Spillway Section SURFACE EL. 542.0

DATE: (START) 7-8-71 (FINISH) 7-8-71 RIG: 719 INSPECTOR:

DEPTH FROM	DEPTH TO	CLASSIFICATION	DATE	TIME	CORE RUN FROM	CORE RUN TO	TOTAL RUN	RECOVERY TOTAL	RECOVERY %
0.0	17.0	Residual Red Clay & Chert Gravel			17.0'	19.5'	2.5'	1.0'	40
		w/ occs. Cobble & Boulder			19.5'	22.2'	2.7'	1.0'	37
17.0	30.0'	Weathered Broken Limestone			22.2'	23.7'	1.5'	1.0'	67
		& Chert w/ Numerous Clay			23.7'	26.0'	2.3'	2.0'	87
		Layers - No water circulation loss			26.0'	28.5'	2.5'	1.0'	40
					28.5'	30.2'	1.7'	0.1'	12
					30.0'	33.0'	3.0'	3.0'	100
					33.0'	34.5'	1.5'	0.7'	47
					34.5'	39.7'	5.2'	5.2'	100
					39.7'	49.7'	10.0'	10.0'	100
					49.7'	59.7'	10.0'	10.0'	100
					59.7'	66.7'	7.0'	7.0'	100
					66.7'	69.2'	2.5'	1.5'	100
					69.2'	70.0'	1.0'	1.0'	100

REMARKS: Casing set to 26'. No water loss below casing.
17.0' - 30.0' Light Gray to Buff Thin Bedded Cherty Limestone
w/Clay seams - Core Grinding due to chert fall in
~~30.0' - 70.0' Light gray Hard, Dense, Limestone w/ Numerous~~
Chert Inclusions

CHART 254

Ira Nathan
Danny

GEOLOGIC INVESTIGATION OF PROPOSED LAKE SITE ON PERUQUE CREEK ST. CHARLES COUNTY

The proposed lake site on Peruque Creek with a dam located in the center of sec. 26, T. 47 N., R. 2 E., will impound waters in a region of limestone bedrock. Rock exposures are soil covered for the most part except for the slopes at the dam site. The thin veneer of soil and rock fragments on the abutments indicates that the earthen fill must be keyed into bedrock.

The limestone bedrock, referred to as the Burlington formation, is firm, massive, and contains a high percentage of chert. The Burlington normally is fissured and open to some extent. The several springs present within the lake area verify this generality. As is customary with limestone bedrock, suitable precautions are necessary so that impounded lake waters are not lost through openings in the limestone. Therefore, the springs which will be in the lower part of the lake such as the spring in the NW¼ SW¼ SE¼ sec. 26, T. 47 N., R. 2 E., should be cleaned of loose rock and soil debris and then padded. The padding should consist of compacted coarse rock covered by two feet of relatively impermeable clay. The lake will probably not have sufficient hydrostatic pressure to reverse the springs, and the failure to pad all the springs should have no adverse affects. However, springs near the dam site, such as the above mentioned outlet should be covered. Springs at or slightly below the water line need not be disturbed.

The rock abutments will consist of firm limestone bedrock except for a several foot thick surficial covering of loose and open layered rock. Therefore, the core trench must be excavated into

CHART 2-55

each abutment a sufficient depth so that the clay core can be compacted against firm rock. This may increase construction costs, but failure to key the earthen core into firm rock on the abutments can result in high water loss and possible instability of the earthen dam.

An excavated rock core trench may not be necessary along the base of the earthen dam. If sufficient relatively tight alluvial material and compacted clay padding cover the present stream channel are extended upstream from the base of the dam, then there will be a limited possibility of water loss along the base of the dam. However, all loose rock material should be cleaned from the bottom of the core trench so that the clay core can be compacted on firm bedrock. If bedrock is at excessive depth then it may be necessary to bottom the core trench on suitable alluvial soil.

An earthen structure of the size contemplated for Peruque Creek should not be undertaken without a thorough knowledge as to the character of the rock. Surface exposures give only a partial indication as to the water tightness of the bedrock. Therefore, additional information as to possible water loss should be obtained by core drilling and pressure testing. Each abutment should be cored and pressure tested with the holes located at the approximate elevation of the pool level. The holes should be deepened to the average level of bedrock surface in the Peruque Valley floodplain. A third hole located along the center line should be covered and pressure tested at least 10 feet into solid rock. If these holes indicate that the rock is open and water loss is excessive, then additional holes will be needed to determine the seriousness of the adverse rock characteristics. Since the lake is not planned

to be excessively deep, the core hole exploration would not be necessary if borrow areas were located near or above water level. However, the need to obtain most of the borrow from the floodplain indicates that the bedrock should be relatively watertight. Some water loss can be tolerated with the high drainage to lake ratios, but if many open caves are noted in the drilling program, then it will be necessary to leave much of the floodplain soil deposits in place. Borrow will have to be obtained at or above water line.

The most apparent construction problem of the lake site may be core trench excavation in the valley alluvium. The floodplain sediments at Peruque Creek may flood much of the earthen excavation. The problem may exist in some borrow areas also. The general groundwater level appears to be at or above floodplain level and this will tend to recharge the alluvium of the floodplain. Therefore, adequate auger exploration should also be accomplished with particular attention given to the water table level in the floodplain. Over all features of the lake site indicate that it is well situated from the geologic aspect. No major hazards were apparent. However, the relatively simple additional exploration should not be ignored when construction of lakes and dams of this magnitude are considered.

James H. Williams
Engineering Geologist
Missouri Geological Survey
February 21, 1963

Eng. Geol.
Lks.

GEOLOGIC REPORT ON THE ST. LOUIS LAKE (BROWNING), ST. CHARLES COUNTY

The proposed lake site is located in the SW¼ NW¼ SE¼ sec. 27, T.47 N., R.2 E. (Troy Quad.). Geologically the location is excellent for water impoundment. The bedrock formation, Keokuk Limestone, is present in the valley area but crops out in very few exposures along the steeper portions of the valley slopes. The Keokuk has limestone beds that are thin to medium in thickness (4" to 2') and interlayered with persistent thick nodules of chert that are in 2" to 6" beds. Most of the valley is covered by a thick mantle of silty clay mixed with chert fragments.

While geologically the area is suitable and there are no major hazards, particular attention must be given to the abutments and valley floor at the dam site. Weathered bedrock exposed near the abutments indicate that seepage could occur along horizontal openings if these are not intercepted by the core trench. Location of the centerline so that small side valley draws can be utilized as part of the abutment core trench will facilitate excavation into fresh unweathered bedrock. Similarly excavation along the floor of the valley should be carried through the weathered bedrock zone. The bedrock excavation may require the use of a rear mounted ripper. It is most important that all weathered bedrock layers in the core be removed even if it should require some drilling and blasting.

During the field examination it was considered that the dam site should be shifted upstream so that the side valley draws could be utilized. This upstream relocation also placed the dam on a more shallow thickness of alluvium than at the originally proposed downstream site. This will further enhance the suitability of the site since it will be easier to complete the core trench excavations. Greater thickness of alluvium such as the downstream site generally involve the problems of more permeable zones consisting of gravels and boulders.

Since subsurface exploration has outlined the nature of the subsoil and bedrock so that major seepage hazards have been noted and a positive cutoff core is planned borrow may be obtained from areas most convenient from an engineering design viewpoint.

James H. Williams
Chief, Eng. Geol. Section
Missouri Geological Survey
September 30, 1966

CHART 2-58

Eng Geol
Reservoir

ADDENDUM TO GEOLOGIC REPORT ON LAKE ST. LOUIS, ST. CHARLES COUNTY

Preliminary seismic exploration in the valley of Perugue Creek indicates that depth to bedrock varies from about 20 feet to at least 32 feet. On the right portion of the valley floodplain, it appears that alluvial silt loam with normal soil moisture has a thickness of 20 to 23 feet. The alluvium is underlain by dense firm limestones consisting of the Keokuk Formation. Toward the center of the valley it appears that about 12 to 16 feet of moist silt loam is underlain by a 12 to 16 foot layer of water saturated sands and gravels. This is in turn underlain at a depth of 30 to 32 feet by limestone. There is no evidence that the limestone surface is extremely pinnacled although it would not be unusual to find variations in relief of 5 to 8 feet in this type of bedrock. However, from a general indication of the type of erosion common to a stream of this size and the preliminary studies by the seismic it would appear that the bedrock surface across the valley floor is relatively uniform.

Velocities in the limestone indicate that it is firm and fresh material. The limestone does not appear to have major caves or extensive soft weathered zones.

The seismic data only outlines the major features of the valley. Subsurface drilling of the bedrock and possible pressure testing are needed to more accurately outline valley conditions.

James H. Williams
Chief, Eng. Geol. Section
Missouri Geological Survey
June 6, 1957

CHART 2-59

ADDENDUM TO LAKE ST. LOUIS, ST. CHARLES COUNTY

Several geologic examinations were made during the work in the core trench. The core for the dam is being completed so that leakage or stability problems associated with geologic features will not affect the dam or lake.

The present plans to investigate in detail the foundation in the area of a spring by drilling, dye studies, and possibly geophysical reconnaissance will provide adequate geological information as to the foundation characteristics near this spring.

The spring flows from a limestone crevice, and is considered to have a bedrock source that is not connected with Peruque Creek. Water temperature of the spring measured on 15 April 1969 was 51°F. Water temperature of Peruque was 63°. The 51°F temperature indicates that warm water contamination is not associated with the spring source. Additional temperature measurements and dye studies should be made for comparison.

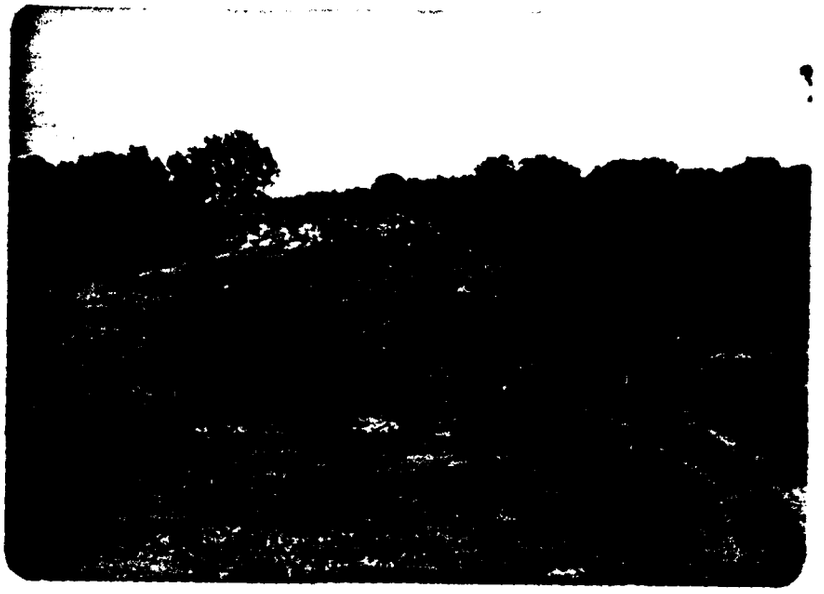
Plans to cut off the spring water flow by grouting are those techniques that are customarily used for sealing off water movement in bedrock crevices. This will be a matter of several bore holes in the water loss area followed by emplacement of the grout.

The localized water loss from Peruque Creek channel into the core trench is not considered to be related to the major source of water coming from this limestone fissure. It is thought that the stream channel loss followed along a more deeply weathered surface of the bedrock. Dewatering of the alluvium and the core trench led to the surface alluvial sinks. Such a phenomena is not unusual when dewatering changes the foundation characteristics of alluvium.

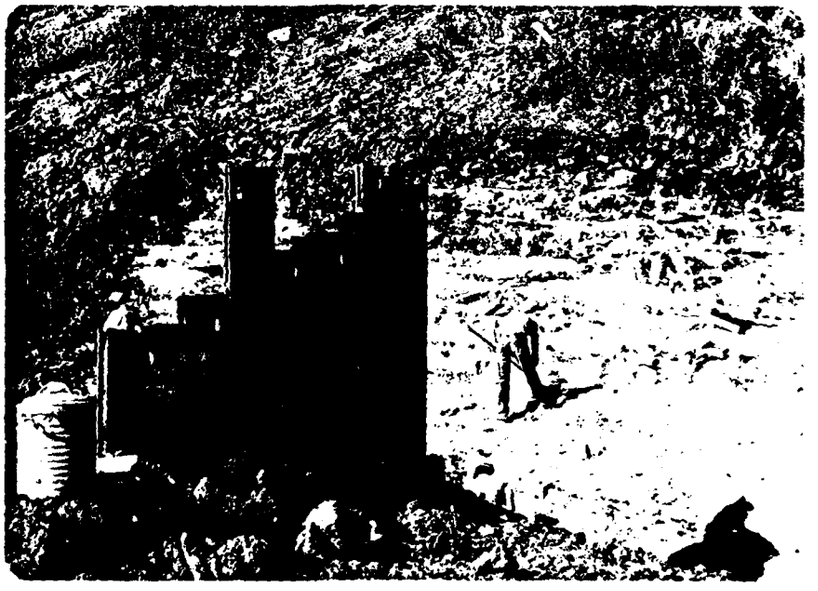
James H. Williams
Chief, Eng. Geol. Section
Missouri Geological Survey
May 12, 1969

CHART 2-60

APPENDIX



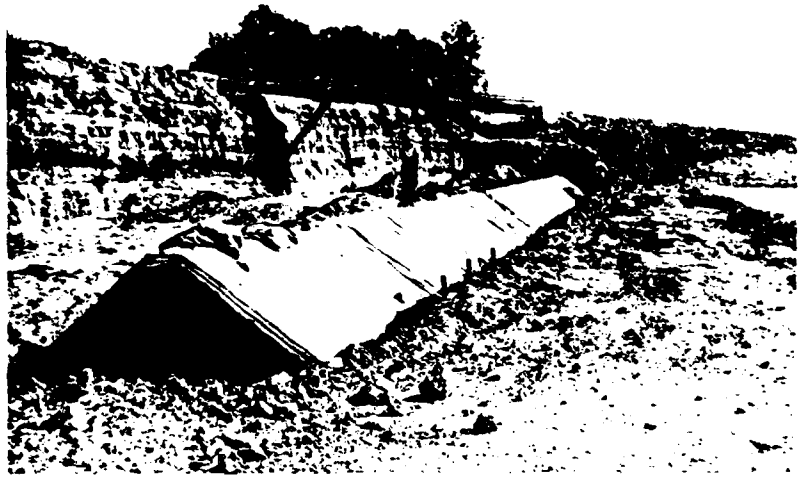
NO. 1: PLACING EARTH FILL AT DAM



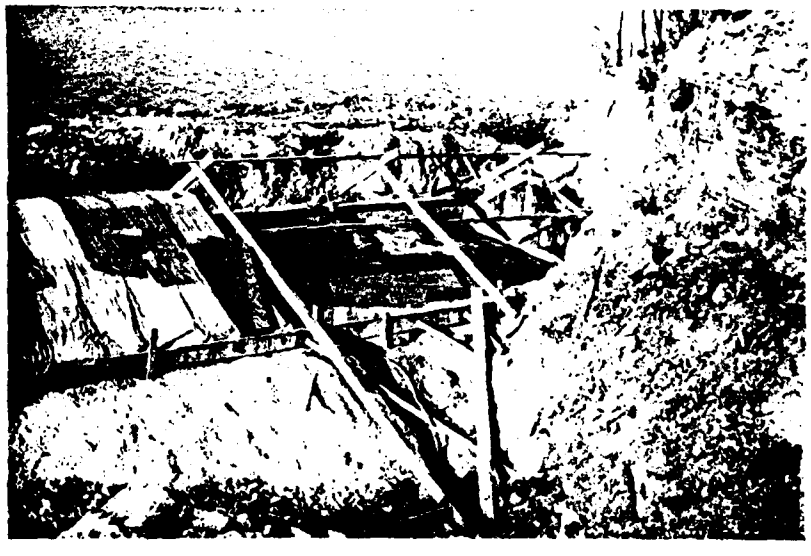
NO. 2: SHEET PILE CUTOFF AT DAM

NO. 3: SPILLWAY - STA. 1+72 TO STA. 2+92

NO. 4: CHANNEL - STA. 9+00 TO STA. 12+00



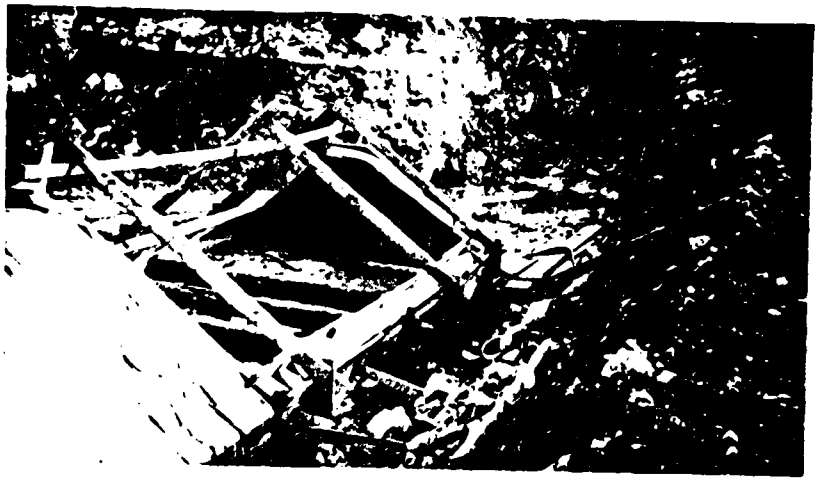
NO. 5: CURING SPILLWAY MONOLITHS



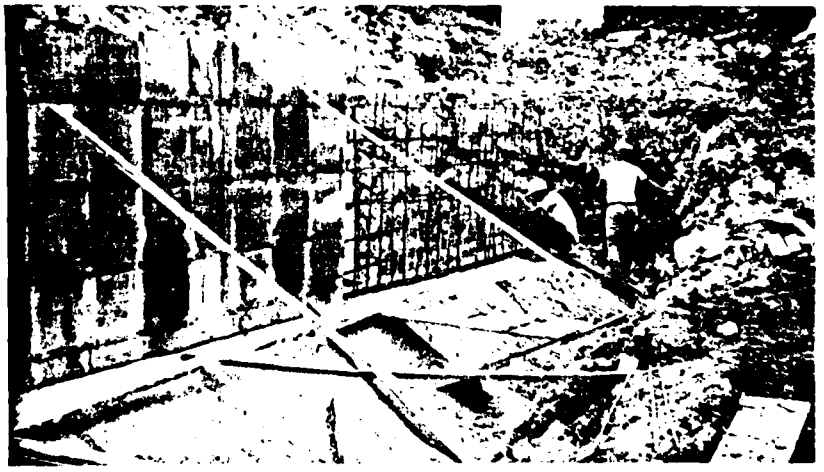
NO. 6: NORMAL POOL SPILLWAY SECTION

NO. 7: CLEANING CAVITY IN SPILLWAY FOUNDATION - STA. 5+75±

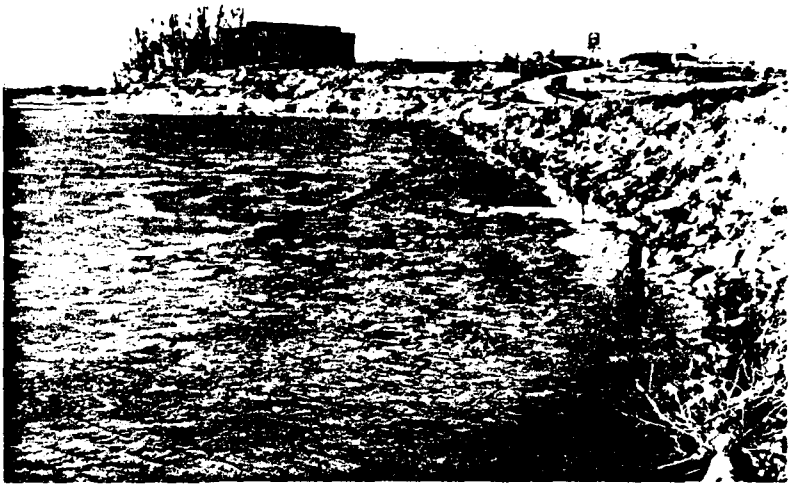
NO. 8: SPILLWAY FOUNDATION - STA. 5+56 TO STA. 5+89



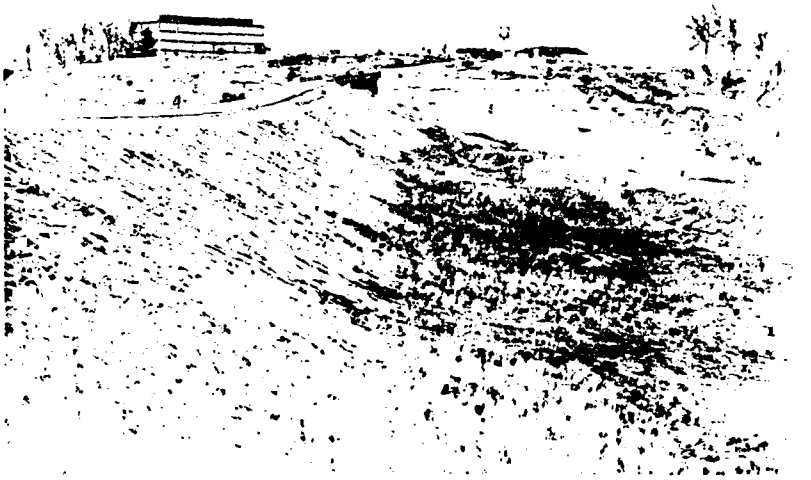
NO. 9: SPILLWAY MONOLITH - STA. 1+24 TO STA. 1+48



NO. 10: SPILLWAY TIE-IN AT DAM



NO. 11: UPSTREAM FACE OF DAM

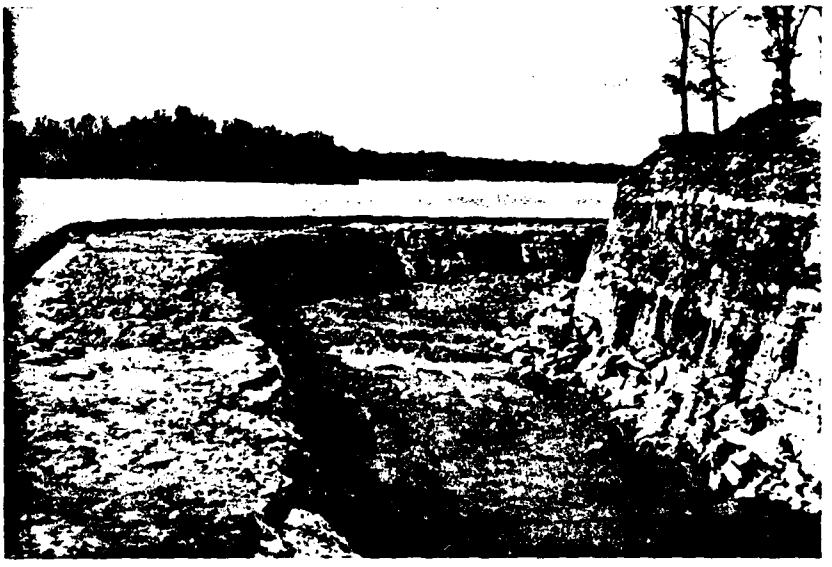


NO. 12: DOWNSTREAM FACE OF DAM

NO. 13: 72" LAKE DRAWDOWN PIPE

NO. 14: SEWAGE LIFT STATION

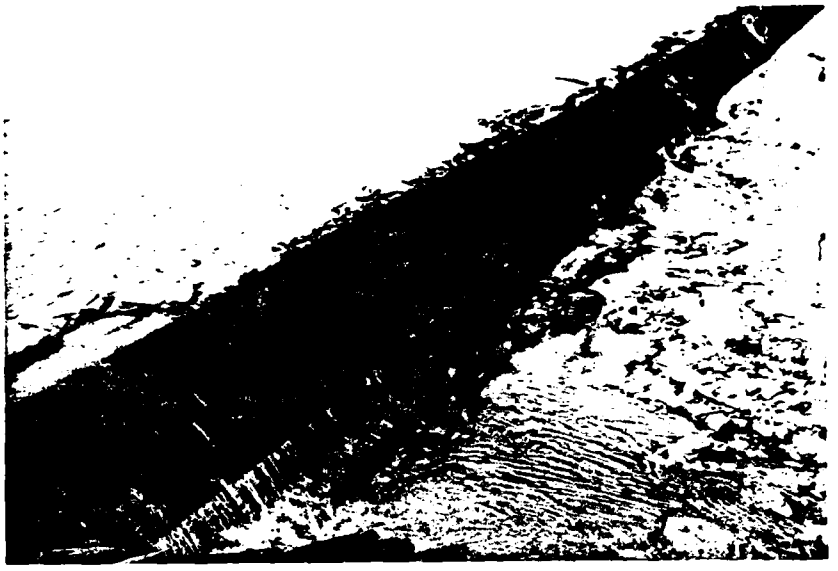
NO. 15: I-70 BRIDGES FROM DAM CREST



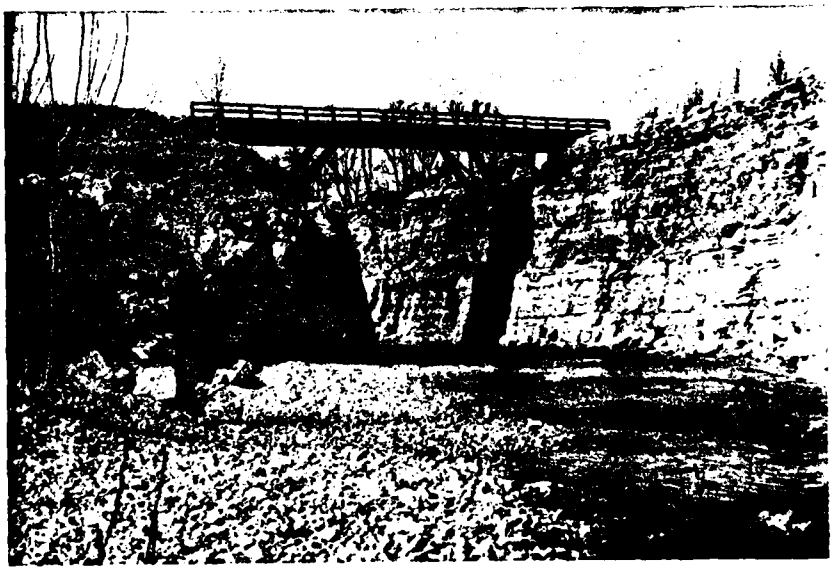
NO. 16: OUTLET CHANNEL FROM DAM CREST

NO. 17: UPSTREAM END OUTLET CHANNEL

NO. 18: CHANNEL BANK - STA. 12+40±



NO. 19: SPILLWAY, NOTE 3-8" PIPES



NO. 20: OUTLET CHANNEL BELOW DAM

NO. 21: HIGHWAY 40-61 BRIDGE

NO. 22: DOWNSTREAM FACE LAKE SAINT LOUISE DAM

HYDROLOGIC COMPUTATIONS

1. Triangular unit hydrographs and the Soil Conservation Service method of runoff determination as described in the Bureau of Reclamation publication "Design of Small Dams" were used to develop the inflow hydrographs (see Plate 16) with hydrologic inputs as follows:

   a. Rainfall from USWB TP40
      (1) 24 hour, probable maximum precipitation rainfall
      (2) 24 hour, Assumption A rainfall
      (3) 24 hour, 300 year rainfall (extrapolated)

   b. Drainage area = 56.4 square miles.

   c. Time of concentration = 9.5 hours.

   d. Antecedent moisture condition = II.

   e. Soil Type CN = 80.

2. Spillway release rates were based on the broad-crested weir equation:

$Q = CLH^{\frac{3}{2}}$ ($C = 3.7$, $L = 817$ feet), where H is the head on the weir crest.

3. Floods were routed through the spillway and outlet channel to determine the capacity of the spillway discharge system. Outflow hydrographs (assuming free discharge from the spillway) are shown on Plate 16.

4. Correlation of flood routing and spillway outlet channel is shown on Plate 17.


40